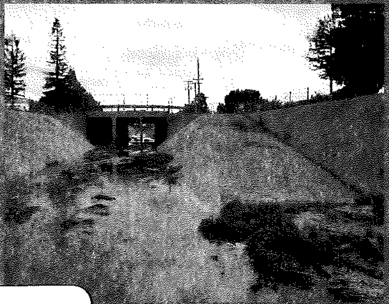
CALABAZAS CREEK CAPACITY IMPROVEMENT PROJECT

CENTRAL EXPRESSWAY TO UPSTREAM OF EL CAMINO REAL

FINAL ENGINEER'S REPORT



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SANTA CLARA VALLEY WATER DISTRICT

CALABAZAS CREEK CAPACITY IMPROVEMENT PROJECT

FINAL ENGINEER'S REPORT

Project No. 20104018

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The Final Engineer's Report has been prepared under the direct supervision of the undersigned, who hereby certifies that he is a Registered Civil Engineer in the State of California.

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Calabazas Creek Capacity Improvement Project
Final Engineer's Report

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Chapter One – Summary

1.1 PURPOSE OF THIS REPORT

This Engineer's Report presents the proposed construction of the Calabazas Creek Capacity Improvement Project. The purpose of this report is to describe the project formulation process, and to allow the Board to make a decision on adopting the Project. The Engineer's Report has been prepared in accordance with Section 10 of the District Act. The Report includes:

- Discussion of the problem definition (Chapter 2);
- Project objective and formulation of alternatives (Chapter 3);
- Evaluation of alternatives (Chapter 4);
- Description of the preferred alternative (Chapter 5);
- Estimated cost, funding, and schedule (Chapter 6);
- Conclusions and recommendations (Chapter 7);
- References.

The District is the lead Agency for the purposes of California Environmental Quality Act (CEQA). The Project is exempt from further review under CEQA Guidelines Section 15302 (c). The Class 2 Categorical Exemption is applicable to Replacement or Reconstruction of existing structures and facilities where the new structure will be located on the same site, serves the same purpose and capacity as the structure replaced. A Notice of Exemption has been prepared and will be filed with the County Clerk's Office to provide public notice consistent with CEQA requirements upon approval of the project.

1.2 INTRODUCTION

The purpose of the Calabazas Creek Capacity Improvement Project (Project) is to identify improvements to channel sections on Calabazas Creek to achieve one-percent flood protection between San Francisco Bay and Miller Avenue, to allow completion of a Letter of Map Revision (LOMR[1]) from the Federal Emergency Management Agency (FEMA).

These channel improvements will remove 2,250 parcels from the existing one-percent floodplain, extending over portions of the cities of Santa Clara, San Jose, and Cupertino. The LOMR will reduce the public's financial burden of the mandatory flood insurance provided by the National Flood Insurance Program (NFIP[2]).

1.3 SUMMARY

The 1992 Calabazas Creek Planning Study identified reaches in Calabazas Creek between San Francisco Bay and Miller Avenue that required channel improvements to achieve one-percent flood protection for the commercial and residential areas that drain to this creek. After construction of those modifications, further analysis identified additional channel modifications needed at certain locations to provide one-percent flood protection and meet FEMA freeboard requirements. Staff informed the District Board of Directors in a CEO Bulletin in February 2005 regarding the need for subsequent channel modifications.

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[1] A LOMR is a letter from FEMA stating that an existing structure or parcel of land would not be inundated by the base flood.

[2] The Mitigation Division, a component of the FEMA, manages the National Flood Insurance Program.

Preferred Project Alternative Description

The preferred project is located between Central Expressway and El Camino Real and consists of the removal of a maintenance ramp downstream of Central Expressway, removal of a maintenance ramp upstream of Kifer Road, removal of a flow separation wall downstream of the UPRR Bridge, modification of the channel invert downstream of the Machado Avenue Bridge, and modification of the channel invert at and upstream of the El Camino Real Bridge. All the project work is located in the City of Santa Clara.

The preferred project does not require any permanent easement or fee title, but it does require temporary construction easements for access and lane closures.

The estimated construction cost for this Project is $2.9 million (2006 dollars). The project work will be funded by the West Valley Watershed Fund.

Public Outreach

A community information meeting was held on September 12, 2006 to provide an update to the community on the Calabazas Creek Flood Protection Project and the proposed work. The meeting also provided information about the process of obtaining a LOMR from FEMA. The meeting participants were in support of the proposed project. A pre-construction meeting will be held with the community in March 2007.

A public hearing on this Engineer's Report will be held and comments will be solicited from the community and responsible agencies. The District Board of Directors will subsequently decide whether to proceed with the preferred project based on community input.

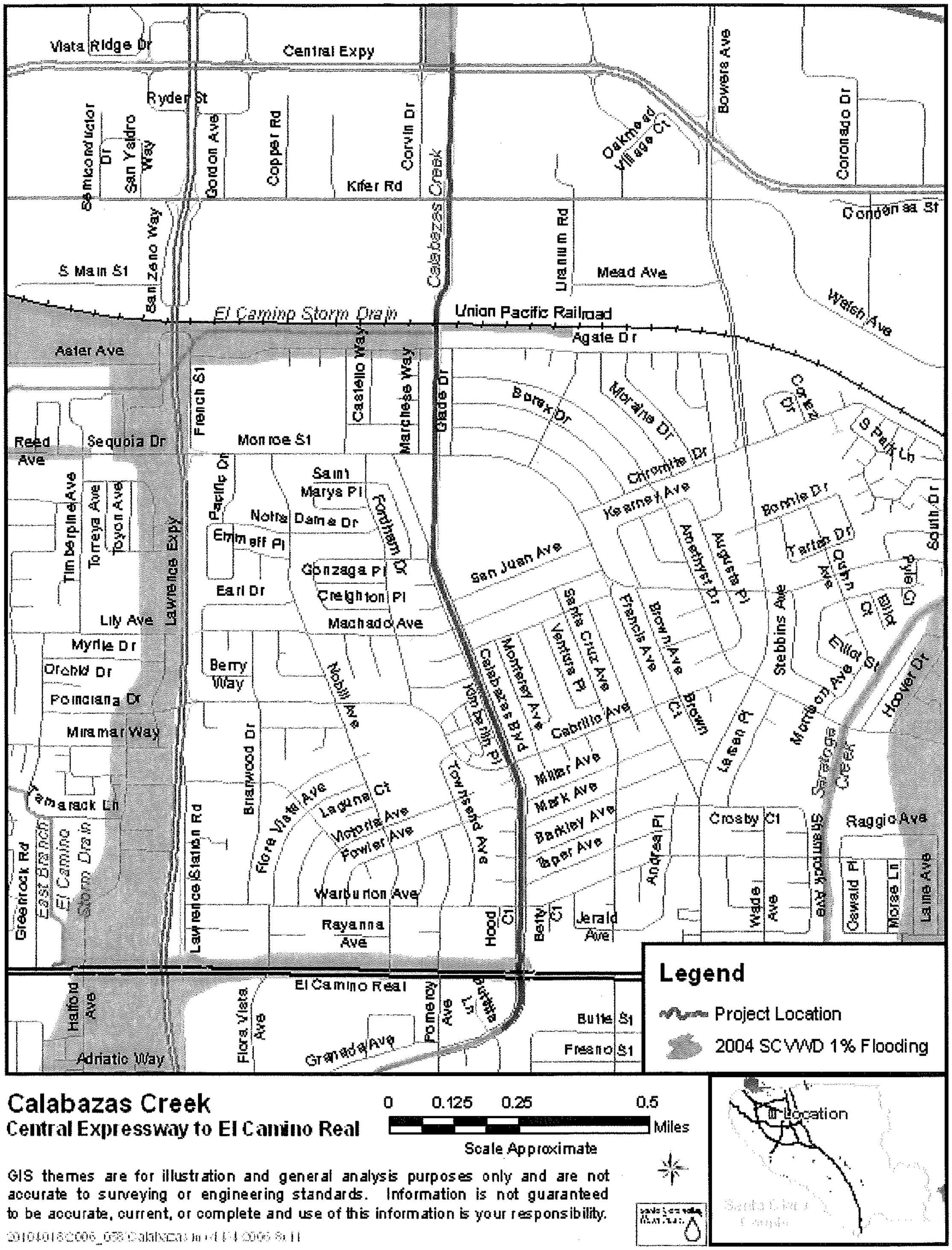
Chapter 2 – Problem Identification

2.1 PROJECT LOCATION AND SETTING

The project site is located between Central Expressway and El Camino Real along Calabazas Creek in the City of Santa Clara and the West Valley Watershed (see Figure 2-1).

The existing channel is a concrete-lined trapezoidal channel, with a five-foot tall flood wall protecting commercial and industrial buildings situated on the east bank upstream of Central Expressway to downstream of Kifer Road. Within the project site, the adjacent properties are used for residential, commercial, and industrial purposes.

The project site can be accessed from a maintenance ramp downstream of Kifer Road to downstream of Central Expressway, and a maintenance ramp upstream of Monroe Street located between the UPRR and Machado Avenue Bridges.



Calabazas Creek
Central Expressway to El Camino Real

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Figure 2-1. Project Location Map

2.2 PROJECT BACKGROUND

Between 1985 and 1999, one-percent level of flood protection improvements were planned, designed and constructed on Calabazas Creek from Guadalupe Slough upstream to Miller Avenue. Following the completion of the flood protection projects in 1999, two revegetation projects were completed in 1999 and 2000 to provide mitigation for the flood protection improvements. The District began preparation of the LOMR (Letter of Map Revision) application for submittal to FEMA to revise the floodplain maps used to designate areas requiring flood insurance.

As part of the LOMR application process, hydraulic analyses were performed in late 2002 based on a combination of data from as-built drawings and survey data collected after the completion of construction activities. The results of the hydraulic analyses indicates that the storm flows in the creek will not meet the FEMA freeboard and one-percent flood capacity criteria at specific locations between Central Expressway and El Camino Real. The locations identified during the modeling were not included in the flood protection improvements completed in 1999, as the early 1990's project planning study indicated that no measures were needed in this reach.

2.3 CURRENT LEVEL OF FLOOD PROTECTION

The updated hydraulic analyses of Calabazas Creek from San Francisco Bay to Miller Avenue, described in the previous section, were completed by the District in late 2002 and will be referred to as "LOMR model" in subsequent discussions. The hydraulic analysis indicates that the creek within this planning area did not meet FEMA criteria for the one-percent flood and freeboard at certain locations. The major cause of flooding is due to inadequate conveyance capacities at the culverts and bridges. Figure 2-2 shows a map of the areas identified by the LOMR model as not having adequate capacity to convey the one-percent flow as required by FEMA or not meeting FEMA criteria for freeboard. Photographs keyed to the map are presented on the following pages. The results of the hydraulic model analysis are described below:

1. San Francisco Bay to Highway 101

Most of this reach has adequate capacity to convey the one-percent flow and provides enough freeboard as required by FEMA. On the east bank, a 1,500 foot long section at the downstream end of the reach has been designed to maintain the current ten-percent flood protection level. The higher flow overtops the banks and spreads to the adjacent Caltrans mitigation site, which will contain all overbank flows generated by a one-percent flood.

2. Highway 101 to 700 feet upstream of Arques Avenue

This reach has adequate capacity to convey the one-percent flow and provides the freeboard required by FEMA.

3. 700 feet upstream of Arques Avenue to 150 feet upstream of Calabazas Blvd.

This reach has adequate capacity to convey the one-percent flow and provide the freeboard required by FEMA, except for the following locations:

a. Downstream of Central Expressway

Hydraulic analysis indicates that the water surface elevation exceeds the top of bank elevation at the maintenance access ramp downstream of Central Expressway. The

LOMR model indicates that the expansion of the channel section at the ramp causes a higher water surface elevation upstream. The hydraulic model developed during the 1992 Planning Study indicated substantially lower water surface elevations (about 3.5 feet lower) than the LOMR model (see photo 2-1).

b. Upstream of Kifer Road

Hydraulic analysis indicates that the minimum available freeboard of the floodwall at the maintenance access ramp upstream of Kifer Road is about 2.2 feet, which does not meet FEMA floodwall standards of 4 feet at and within 100 lineal feet both upstream and downstream of the Kifer Road Bridge. The LOMR model indicates that the expansion of the channel section at the ramp causes higher water surface elevations (see photo 2-2).

c. Upstream and Downstream of UPRR Bridge

Hydraulic analysis indicates that the water surface elevation exceeds the bank elevation just upstream and downstream of the UPRR Bridge. The LOMR model indicates that the increased water surface elevation was a result of a backwater effect caused by the merging of flows from El Camino Real Storm Drain with flows from Calabazas Creek (see photo 2-3).

d. Upstream of Monroe Avenue

Hydraulic analysis indicates that at the upstream face of the Monroe Avenue Bridge, the water surface profile exceeds the bank elevation due to the backwater effect at the UPRR Bridge. The water surface elevation just downstream of the Monroe Avenue Bridge is higher in the LOMR model than in the 1992 Planning Study model.

4. 150 feet upstream of Calabazas Boulevard to Downstream of El Camino

The LOMR model results indicate that this reach does not have the capacity to convey the one-percent flow. At the upstream side of the Machado Avenue Bridge, the LOMR model calculated water surface elevation is 59.7 feet, which is about 0.9 feet higher than the low chord of the bridge and 1 foot higher than the 1992 Planning Study model results. The LOMR model results indicate a backwater effect for a distance of about 700 feet upstream of the bridge. This backwater effect will cause flood flows during a one-percent flood to overtop the banks upstream of the bridge (see photo 2-4).

5. 400 feet Downstream of El Camino Real to 1,000 feet Upstream

The LOMR model results indicates that this reach does not have the capacity to convey the one-percent flow due to what have now been determined to be lower flow velocities upstream of the El Camino Real Bridge. The LOMR model indicates water overtopping the banks along 600 feet of the creek upstream of the El Camino Real Bridge. Just downstream from the El Camino Real Bridge, the invert slope changes from 0.0025 (0.25%) to 0.01 (1%); hence, higher flow velocities would prevail downstream of the El Camino Real Bridge. The 1992 Planning Study modeling assumed higher flow velocities both upstream and downstream of the El Camino Real Bridge. Accounting for the change in invert slope from upstream to downstream of the El Camino Real Bridge, the LOMR model results indicate that the water surface elevation upstream of the bridge is 1.5 feet higher than that calculated for the 1992 Planning Study model (see photo 2-5).

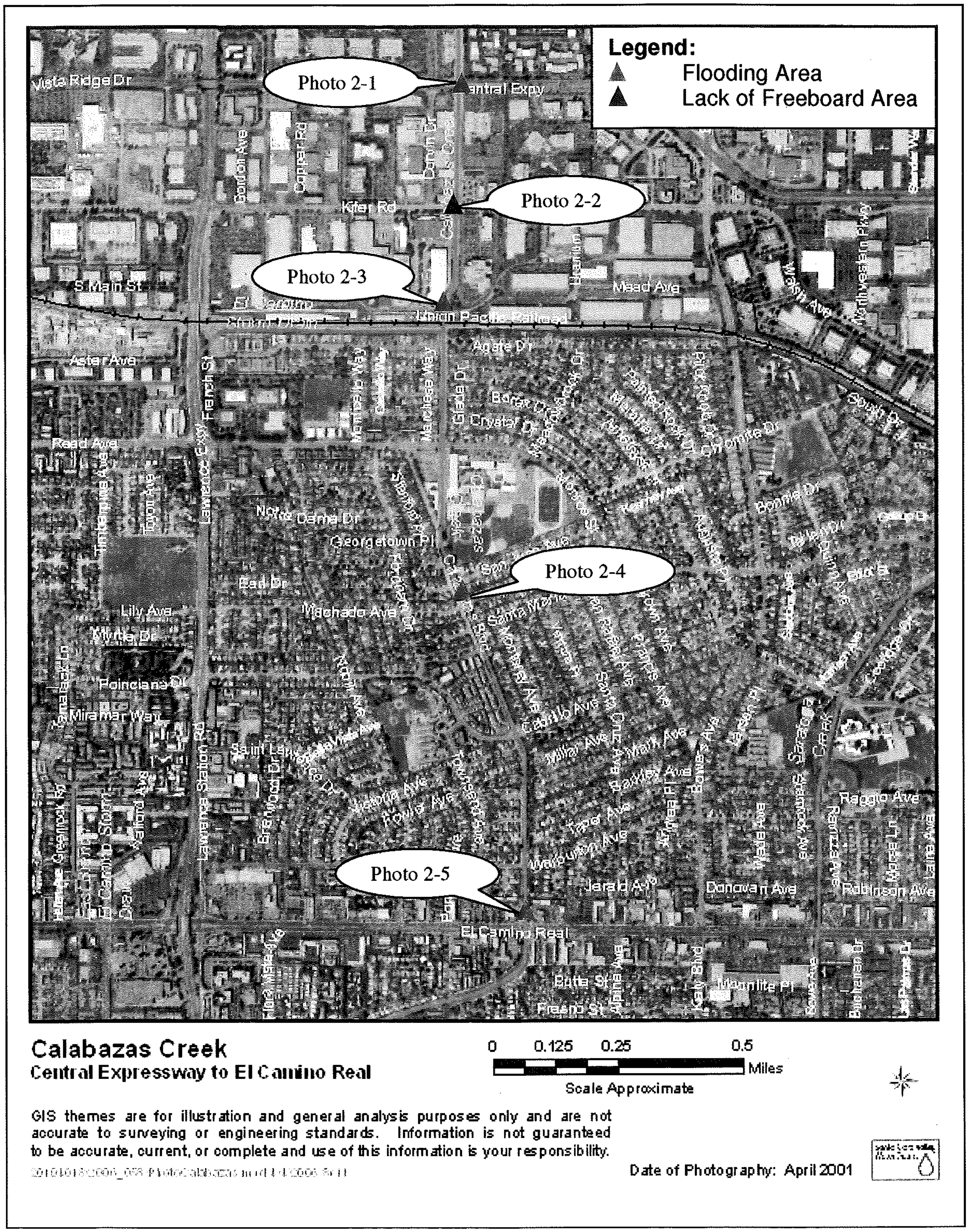
Legend:
▲ Flooding Area
▲ Lack of Freeboard Area
Photo 2-1
Photo 2-2
Photo 2-3
Photo 2-4
Photo 2-5
Central Expy
Kifer Rd
S Main St
Mead Ave
Union Pacific Railroad
Lawrence Expy
Lawrence Station Rd
El Camino Real
Calabazas Creek
Central Expressway to El Camino Real
0 0.125 0.25 0.5 Miles
Scale Approximate
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Figure 2-2. Map of Locations of One-percent Flooding or Lack of Freeboard along Calabazas Creek

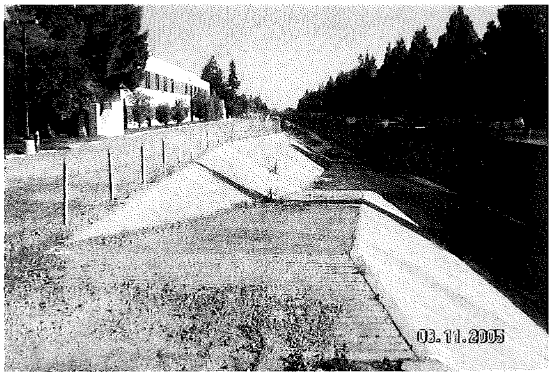


Photo 2-1 Water surface elevation exceeds the top of bank elevation at the maintenance access ramp downstream at Central Expressway

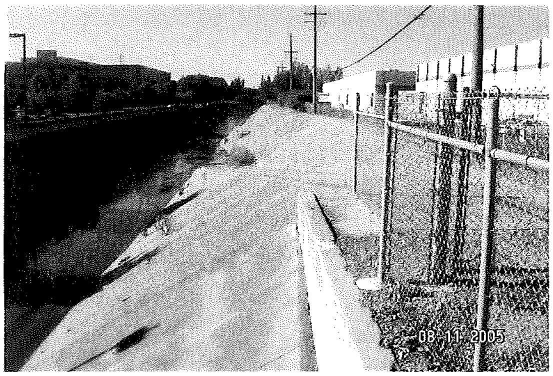


Photo 2-2 Available freeboard of the floodwall at the maintenance access ramp upstream of Kifer Road does not meet FEMA floodwall standards

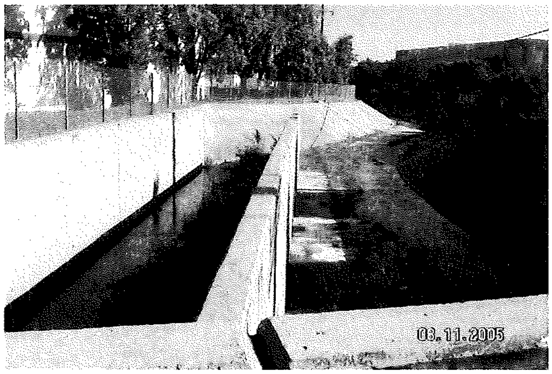


Photo 2-3 Water surface elevation exceeds the bank elevation due to flow separation wall downstream of the UPRR Bridge

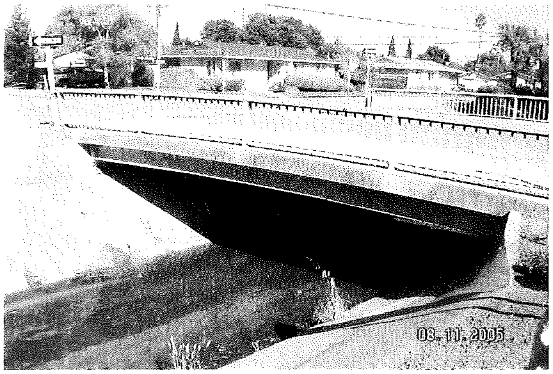


Photo 2-4 Lack of channel capacity downstream of the Machado Avenue Bridge causes a backwater effect upstream of the bridge

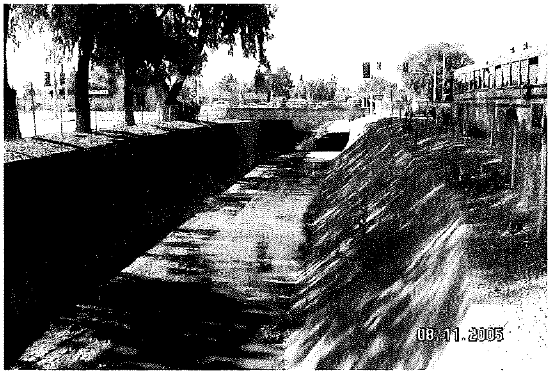


Photo 2-5 This reach does not have the capacity to convey the one-percent flow due to lower flow velocities upstream of the El Camino Real Bridge

2.4 GEOTECHNICAL AND GEOLOGICAL SETTING

Geotechnical investigations were conducted along Calabazas Creek in 1992 from Guadalupe Slough to Pomeroy Avenue (Whaler Associates, 1992). The findings indicated that Calabazas Creek traverses an alluvial fan generally composed of discontinuous silts, sands and gravels. Near San Francisco Bay, the alluvial fan has alternate subsurface layers of impervious and pervious deposits. Groundwater beneath the Calabazas Creek alignment occurs largely under confined conditions. The groundwater encountered in the borings mostly occurs in the more permeable, coarser-grained silty and gravelly sand layers interbeddeded with less permeable silty clay and clayey slit layers. Groundwater within the project area was encountered during drilling at a depth of 14 to 20 feet. Between Machado Avenue and El Camino Real, the creek subsurface consists of sandy and silty clays. No groundwater has been encountered up to 20 feet in this reach.

2.5 HYDROLOGY AND HYDRAULICS

Calabazas Creek has a history of flooding which has damaged existing structures, and impacted businesses and residences. Storms in February 1998 caused extensive street flooding damage to residential properties and created hazardous conditions at roadways. A peak flow of 2,970 cubic feet per second (cfs) during the 1998 storms caused flooding at Saratoga-Sunnyvale Road, Bollinger Road, Miller Avenue, Tantau Avenue, Pruneridge Avenue and Monroe Street.

The one-percent flood event based on District hydrological methods (SCVWD, August 2005) at various locations along Calabazas Creek is shown in the table below:

Table 2-1. One-Percent Flood Flows in Cubic Feet per Second (cfs) at Various Locations in Calabazas Creek between San Francisco Bay and Miller Avenue

Location	One-percent Flood Flow (cfs)
Highway 280	3,000
Upstream El Camino Storm drain	3,100
UPRR Bridge	3,800
Highway 237	4,300

2.6 HAZARDOUS MATERIALS

Project staff have reviewed findings from a study on soil contamination (Wahler Associates, 1992), and concluded that there is no potential for soil contamination impact to the proposed project.

Chapter 3 – Project Objective and Formulation of Alternatives

3.1 PROJECT OBJECTIVE

The project objective is to provide continuous one-percent flood protection between San Francisco Bay and Miller Avenue to remove 2,250 parcels from the one-percent floodplain. This objective is consistent with Board Ends Policy No. E-2, Article 2.2.1.1 *(Homes, schools, businesses, and transportation networks are protected from flooding and erosion).*

3.2 PLANNING STUDY CRITERIA FOR FORMULATION OF ALTERNATIVES

The criteria used to formulate alternatives, evaluate alternatives, and select and develop the preferred alternative are as follows:

- One-Percent Flood Capacity and Freeboard
- Hydraulic Design Criteria
- Structural, Geotechnical, and Seismic Design Criteria
- Environmental Impacts
- Project Cost and Schedule
- Community Concerns
- Rights of way
- Utility Conflicts
- Hazardous Materials

3.2.1 ONE-PERCENT FLOOD CAPACITY AND FREEBOARD

The one-percent flood will be the design flood flow for the project based on the Federal Emergency Management Administration (FEMA) or District freeboard criteria, whichever is higher.

3.2.2 HYDRAULIC DESIGN CRITERIA

The range of Manning's 'n' used for hydraulic analysis is 0.013 – 0.018, applicable for concrete lined channels. Transition between flow regimes was designed to occur smoothly and safely.

3.2.3 STRUCTURAL, GEOTECHNICAL, AND SEISMIC DESIGN CRITERIA

The project includes structural, geotechnical, and seismic design criteria to guide the design and implementation of the improvements to Calabazas Creek. Each feasible alternative considered required that design be within the realm of generally accepted structural engineering criteria. Geotechnical concerns included the influence of groundwater on construction and the support of temporary excavation during construction.

3.2.4 ENVIRONMENTAL IMPACTS

The District is the lead agency for this project which is subject to compliance with the CEQA. The project will require permits from state resource agencies for construction and operation.

3.2.5 PROJECT COST

Feasible alternative cost estimates were prepared to allow comparative evaluation.

3.2.6 COMMUNITY CONCERNS

Input from members of the community was an important factor in the evaluation of feasible alternatives. The District held a public meeting to solicit input and identify any relevant issues and concerns.

3.2.7 RIGHTS OF WAY

Feasible alternatives may require additional lands for temporary construction easements for the following: right of entry, site access, and staging areas. Feasible alternatives may also require the temporary closure of lanes on streets to allow for equipment access. These requirements were evaluated for their cost and schedule impact.

3.2.8 UTILITY CONFLICTS

Calabazas Creek runs through residential and urbanized areas with underground and overhead infrastructures; thus, utilities exist within the project area. The impact of interference with existing utilities was evaluated for all feasible alternatives.

3.2.9 HAZARDOUS MATERIALS

Project locations have no known soil contamination based on a study of soil contamination data (Wahler Associates, 1992).

3.3 FORMULATION OF ALTERNATIVES

Alternatives for the project were developed based on an extensive and thorough screening process. Alternatives were developed and tested against the project objective to screen out possible alternatives that were infeasible. The formulation of the alternatives were based on the assessment of (1) their ability to meet the project objective; (2) minimize project cost; (3) minimize impacts on the environment and community; and (4) public input.

Chapter 4 – Evaluation of Alternatives

The three feasible alternatives considered for this project were evaluated using the project formulation criteria presented in the previous chapter. The feasible alternatives considered for this project are:

1. No Project
2. Capacity Improvement with Channel Modifications
3. Capacity Improvement with Channel Modifications and Bridge Modification at Machado Avenue

4.1 ALTERNATIVE 1 – NO PROJECT

The "No Project" alternative assumes "existing conditions" and evaluates the "likely" future conditions in the project area without implementation of the recommended alternative. Under the "No Project" alternative, flooding and channel degradation within this reach would not be addressed. Therefore, the "No Project" alternative does not meet the project objective and is eliminated from further consideration.

There is no cost associated with implementing the No Project alternative; however, the no project alternative will likely cause damages to 2,250 properties from flooding in a one-percent event, and there is an ongoing cost to the public to continue to maintain flood insurance protection.

4.2 ALTERNATIVE 2 – CAPACITY IMPROVEMENT WITH CHANNEL MODIFICATIONS

This alternative incorporates channel modifications to improve channel capacity at Central Expressway, Kifer Road, UPRR Bridge, Machado Avenue, and El Camino Real (see Figure 4-1). The proposed measures for this alternative are as follows:

> *Downstream of Central Expressway* – The maintenance ramp downstream of Central Expressway will be removed and the channel banks reconstructed to match the existing slope. The ramp will be replaced with a sloped wing wall, extending from the downstream face of the bridge and tied into the existing channel top of bank (Site 1).
>
> *Upstream of Kifer Road* – The maintenance ramp upstream of Kifer Road will be removed and the channel banks reconstructed to match the existing slope. The ramp will be replaced with a vertical wing wall, extending from the upstream face of the bridge and tied into the existing channel top of bank (Site 2).
>
> *Upstream and Downstream of UPRR Bridge* – An existing flow separation wall downstream of the UPRR Bridge will be removed to resolve the insufficient channel conveyance capacity in this area (Site 3).

Downstream of Machado Avenue – The low flow channel will be deepened by 4 feet from upstream of the Machado Avenue Bridge to 640 feet downstream (Site 4).

Upstream of El Camino Real – The low flow channel will be deepened by 3 feet from approximately 400 feet downstream of El Camino Real Bridge to 1,000 feet upstream (Site 5).

The estimated cost for construction for Alternative No. 2—Capacity Improvements with Channel Modification is $2.9 million. A detailed breakdown of the costs associated with this alternative is provided in Appendix A.

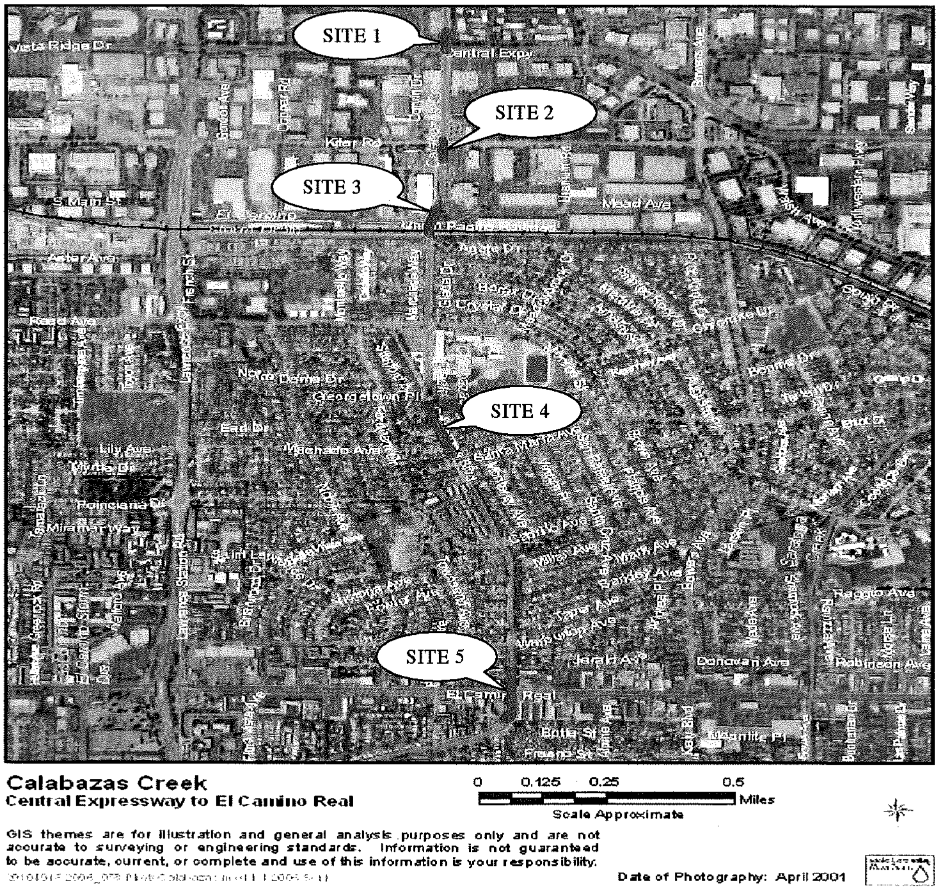
SITE 1 – REMOVE MAINTENANCE RAMP DOWNSTREAM OF CENTRAL EXPRESSWAY.

SITE 2 – REMOVE MAINTENANCE RAMP UPSTREAM OF KIFER ROAD

SITE 3 – REMOVE FLOW SEPARATION WALL DOWNSTREAM OF UPRR BRIDGE

SITE 4 – DEEPEN LOW FLOW CHANNEL BY 4 FEET FROM UPSTREAM OF MACHADO AVE. TO 640 FEET DOWNSTREAM.

SITE 5 – DEEPEN LOW FLOW CHANNEL BY 3 FEET FROM APPROXIMATELY 400 FEET DOWNSTREAM OF EL CAMINO REAL TO 1,000 FEET UPSTREAM.



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Date of Photography: April 2001

Figure 4-1. Map of Calabazas Creek Showing Locations of Proposed Measures for Feasible Alternatives

4.3 ALTERNATIVE 3 – CAPACITY IMPROVEMENT WITH CHANNEL MODIFICATIONS AND BRIDGE MODIFICATION AT MACHADO AVENUE

This alternative incorporates channel modifications to improve channel conveyance capacity at Central Expressway, Kifer Road, UPRR Bridge, El Camino Real, and includes modification to the bridge at Machado Avenue. The proposed measures for this alternative are the same as Alternative 2; however, under Alternative 3, the proposed measure would rebuild the Machado Avenue Bridge to increase the clearance between the low chord and the water surface elevation, thus eliminating the need to deepen 640 lineal feet of channel downstream of the bridge.

The estimated cost for construction for Alternative No. 3—Capacity Improvements with Channel Modifications and Bridge Modification at Machado Avenue is $3.6 million. Alternative 3 would require additional time and cost for obtaining permits and performing construction. A detailed breakdown of the costs associated with this alternative is provided in Appendix A.

Table 4-1 summarizes the evaluation of the feasible alternatives for the Project.

Table 4-1. Comparative Summary of Feasible Alternatives

Issues and Concerns	**ALTERNATIVE 1** No Project	**ALTERNATIVE 2** Capacity Improvements with Channel Modification	**ALTERNATIVE 3** Capacity Improvement with Channel Modifications and Bridge Modification at Machado Ave.
1. One Percent Flood Capacity and Freeboard	Existing flooding and damage threat persists.	Provides protection for the one-percent flood capacity and freeboard.	Provides protection for the one-percent flood capacity and freeboard.
2. Construction Cost Estimate	$0	$2.9M*	$3.6 M*
3. General Description	No measures taken to reduce risk of flooding. Existing conditions would remain, if not worsen.	(a) Remove maintenance ramp downstream of Central Expressway and reconstruct the channel banks to match the existing bank slopes. (b) Remove maintenance ramp upstream of Kifer and reconstruct the channel banks to match the existing bank slopes. (c) Remove existing flow separation wall downstream of the UPRR Bridge. (d) Deepen low flow channel by 4 feet from just upstream of the Machado Avenue Bridge to 640 feet downstream. (e) Deepen low flow channel by 3 feet from approximately 400 feet downstream of El Camino Real Bridge to 1,000 feet upstream.	(a) Remove maintenance ramp downstream of Central Expressway and reconstruct the channel banks to match the existing bank slopes. (b) Remove maintenance ramp upstream of Kifer and reconstruct the channel banks to match the existing bank slopes. (c) Remove existing flow separation wall downstream of the UPRR Bridge. (d) Raise bridge at Machado Avenue. (e) Deepen low flow channel by 3 feet from approximately 400 feet downstream of El Camino Real Bridge to 1,000 feet upstream.
4. Rights of way	None required	Temporary construction easements and temporary lane closure needed for site access.	Temporary construction easements, temporary lane closure needed for site access. Road closure at Machado Avenue for bridge construction.
5. Utility Conflicts	No conflicts	Utility conflicts at Kifer Road and Machado Avenue	Utility conflicts at Kifer Road and Machado Avenue
6. Permits	No permits	Regulatory permits and Caltrans Encroachment permit required.	Regulatory permits, City permits, and Caltrans Encroachment permits required.

*Estimated construction cost does not include cost for permit acquisition.

4.4 ADVANTAGES AND DISADVANTAGES OF PROJECT ALTERNATIVES

Table 4-2 lists the advantages and disadvantages of the three alternatives developed for the Calabazas Creek Capacity Improvement Project based on the extent to which the alternatives meet the project objective.

Table 4-2. Advantages and Disadvantages of Feasible Alternatives

PROPOSED PROJECT ALTERNATIVES		
ALTERNATIVE 1 No Project	**ALTERNATIVE 2** Capacity Improvement with Channel Modifications	**ALTERNATIVE 3** Capacity Improvement with channel Modifications and Bridge Modification at Machado Ave.
ADVANTAGES		
No cost to implement alternative.	Meets one-percent flood protection and FEMA and District freeboard criteria. Lower construction cost compared to Alternative 3. Shorter duration for planning, design, and construction compared to Alternative 3.	Meets one-percent flood protection and FEMA and District freeboard criteria.
DISADVANTAGES		
Does not meet one-percent flood protection and FEMA and District freeboard criteria; parcels in vicinity of project area are still subject to flooding in large storm events. Up to 2,250 property owners must continue to carry flood insurance.	Short-term project impacts include construction noise and air quality concerns. Temporary lane closures needed for site access. Temporary construction easements needed for project. Conflicts with existing utilities. Eliminates downstream ramp at Central Expressway and upstream ramp at Kifer Road.	Short-term project impacts include construction noise and air quality concerns. Temporary lane closures needed for site access. Temporary construction easements needed for project. Conflicts with existing utilities. Eliminates downstream ramp at Central Expressway and upstream ramp at Kifer Road. Complete road closure and detour needed at Machado Avenue. Additional cost for necessary bridge modifications permits. Longer duration for planning, design, and construction and higher cost as compared to Alternative 2.

Chapter 5 – Description of the Preferred Project Alternative

5.1 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The preferred alternative must meet the project objective of providing one-percent flood protection with freeboard, consistent with District policy, minimize project cost, environmental impacts, and support timely completion of the LOMR process.

Based on a comparison and evaluation of the project objective, estimated costs, and potential impacts associated with the three Project alternatives, Alternative 2 – Capacity Improvement with Channel Modification is recommended as the preferred project alternative for District Board approval. The Project is exempt from further review under CEQA Guidelines Section 15302 (c). The Class 2 Categorical Exemption is applicable to Replacement or Reconstruction of existing structures and facilities where the new structure will be located on the same site, serves the same purpose and capacity as the structure replaced. A Notice of Exemption has been prepared and will be filed with the County Clerk's Office to provide public notice consistent with CEQA requirements upon approval of the project.

PROJECT WORK

- **Removal of maintenance ramp downstream of Central Expressway**

The maintenance ramp downstream of Central Expressway will be removed and the channel banks reconstructed to match the existing slope. The ramp will be replaced with a sloped wing wall, extending from the downstream face of the bridge and tied into the existing channel top of bank.

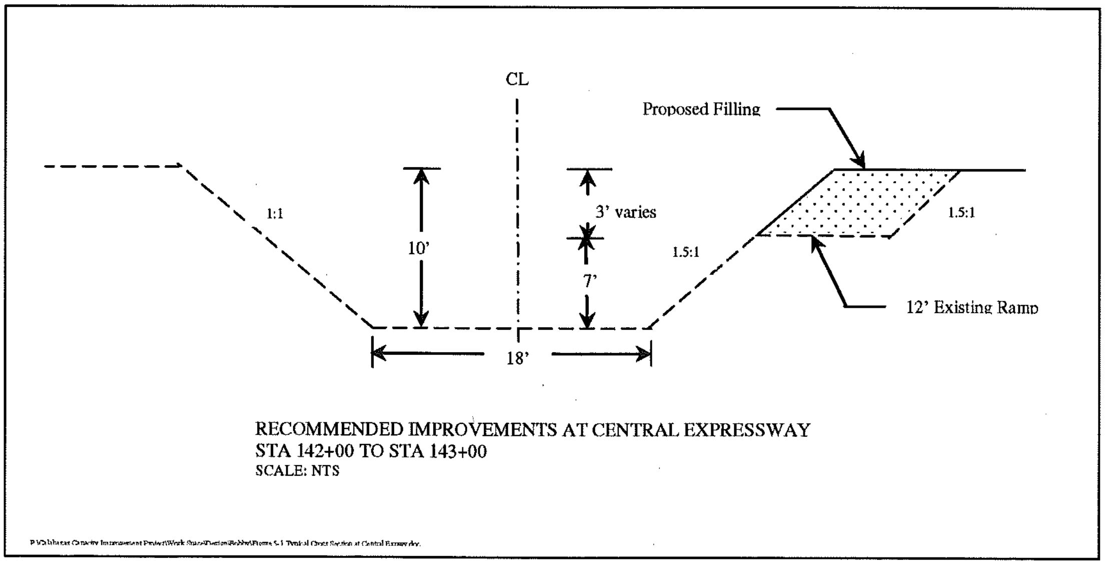


Figure 5-1. Typical Cross Section for Recommended Improvements at Central Expressway

- **Removal of maintenance ramp upstream of Kifer Road**

The maintenance ramp upstream of Kifer Road will be removed and the channel banks reconstructed to match the existing slope. The ramp will be replaced with a sloped wing wall, extending from the upstream face of the bridge and tied into the existing channel top of bank.

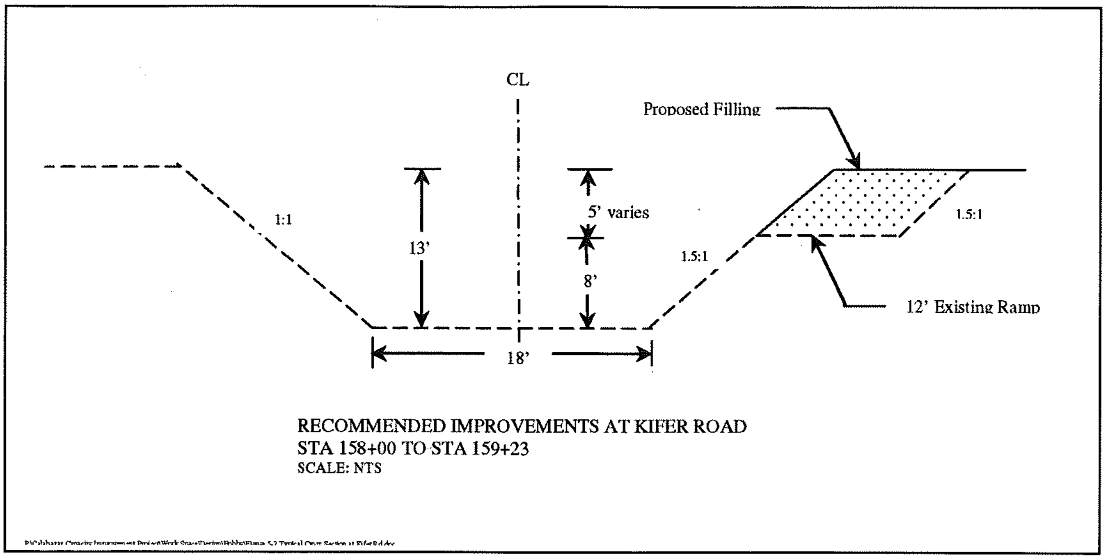


Figure 5-2. Typical Cross Section for Recommended Improvements at Kifer Road

- **Removal of a flow separation wall downstream of UPRR Bridge**

An existing flow separation wall downstream of UPRR Bridge will be removed to resolve the insufficient channel conveyance capacity in this area.

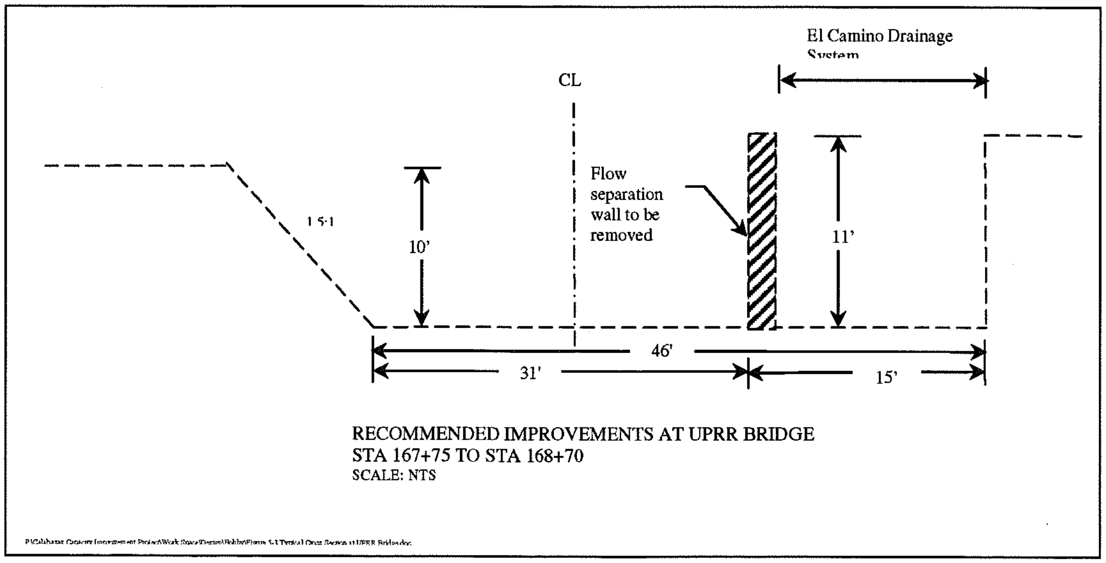

El Camino Drainage System
CL
Flow separation wall to be removed
1.5:1
10'
11'
46'
31'
15'
RECOMMENDED IMPROVEMENTS AT UPRR BRIDGE
STA 167+75 TO STA 168+70
SCALE: NTS

Figure 5-3. Typical Cross Section for Recommended Improvements at UPRR Bridge

- **Modification of channel invert downstream of Machado Avenue Bridge**

The low flow channel will be deepened by 4 feet from just upstream of the Machado Avenue Bridge to 640 feet downstream.

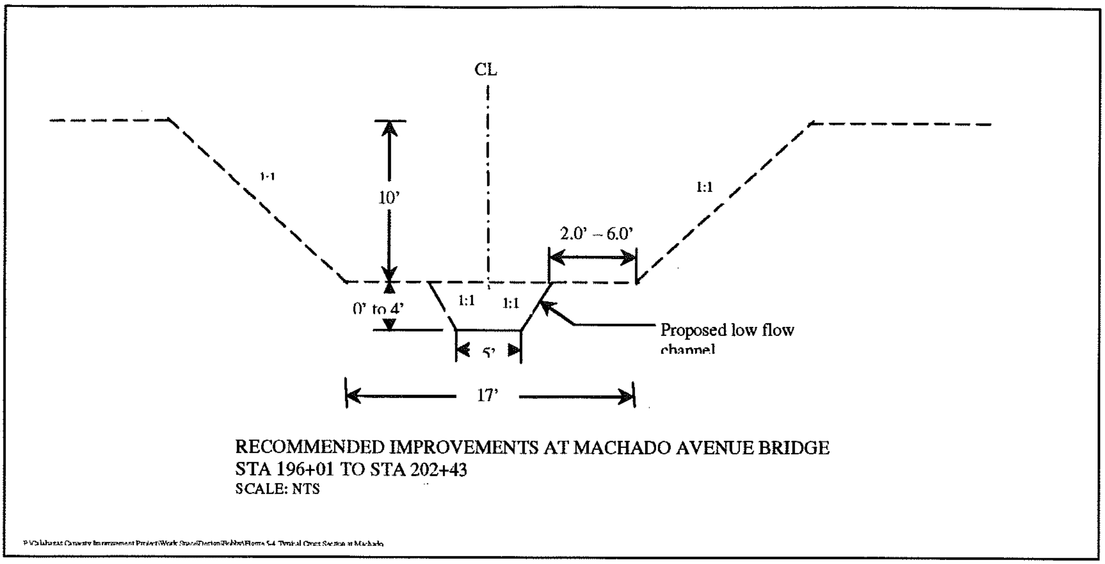


Figure 5-4. Typical Cross Section for Recommended Improvements at Machado Avenue Bridge

- **Modification of channel invert at and upstream of El Camino Real Bridge**

The low flow channel will be deepened by 4 feet from the pedestrian bridge just downstream of the El Camino Real Bridge to 1,000 feet upstream.

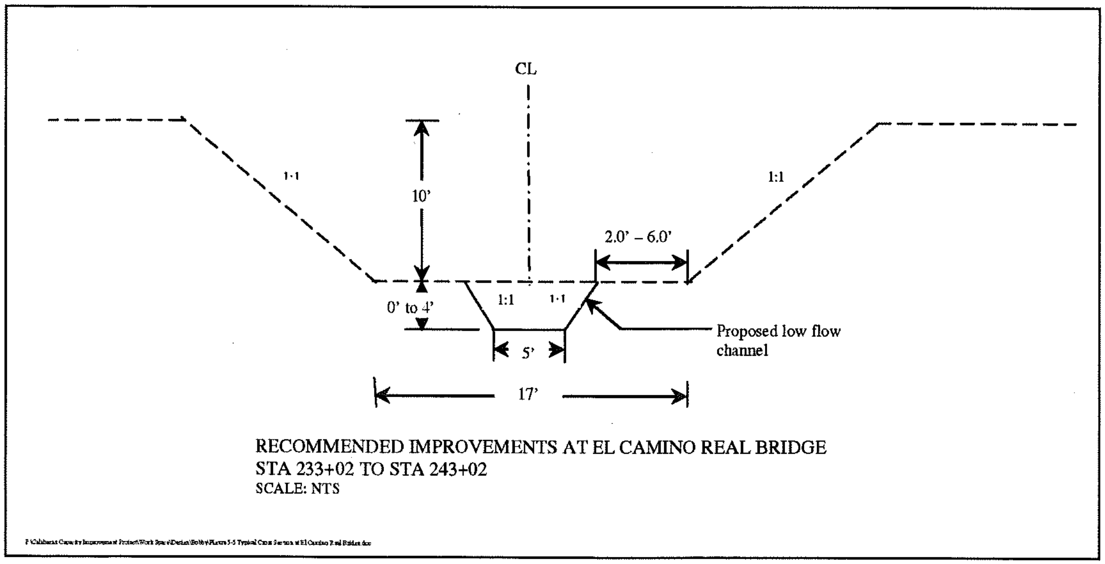


Figure 5-5. Typical Cross Section for Recommended Improvements at El Camino Real Bridge

The Project will generate spoil, consisting of concrete rubble and soil. Materials generated from the Project will be transported to one of the nearby landfills. In the event that stormwater flows occur within the project during construction, enclosures or flow barriers will be erected by the Contractor around the work areas to prevent stormwater flows from entering the work areas, and to prevent sediments and other pollutants discharged in stormwater flows leaving the project work area.

The construction of the proposed project will be carried out consistent with District guidelines and Best Management Practices (BMP's) from the latest California Stormwater BMP Handbook. Construction is scheduled to begin in April 2007 and to be completed by December 2007.

5.2 POTENTIAL PROJECT IMPACTS

Noise Impacts
Construction activities will result in temporary noise impacts to the surrounding sites. The use of diesel-powered equipment, jackhammers, and other equipment will result in relatively high noise levels adjacent to the project site. Pumps could be used to transport water around work areas which will result in temporary noise impacts.

Traffic Impacts
Construction of the project could affect traffic in the short term due to heavy haul trucks used to transport material to and from the project site. The access of construction vehicles onto the project site may result in traffic impacts on the nearby streets at Central Expressway and Kifer Road, and lane closures along Calabazas Boulevard at Machado Avenue and El Camino Real.

Air Quality Impacts
Construction activities may result in short term local air quality (dust and exhaust) impacts. Construction and demolition activities may also raise dust and track mud on the streets.

Utility Conflicts
Construction activities will impact a sanitary sewer line at El Camino Real, an electrical overhead line at Kifer Road and two telephone wires that cross the creek downstream of Machado Avenue. These facilities will be relocated or protected during construction.

Water Quality Impacts
Construction activities may impact the water quality downstream of the project sites, which may include pH, turbidity, water temperature, flow rate, and etc. Monitoring and testing for these water quality or quantity parameters will be included in the construction specifications.

5.3 CONSTRUCTION MONITORING

Detailed plans and specifications will be developed by staff, and District inspectors will oversee implementation to ensure conformance to the construction specification. The plans and specifications developed for the project include detailed information on the project staging, laydown, and parking during construction.

5.4 OPERATION AND MAINTENANCE PROGRAM

Routine operation and maintenance activities on this creek will not be impacted by the project. Operation and maintenance include keeping the channel sufficiently clear to provide one-percent flood capacity at all times, eliminating hazardous conditions and tending to the facility as necessary. General tasks to be performed during annual maintenance operations include fence repairs, trash and graffiti removal, weed control, and elimination of any potentially hazardous conditions. Removal of sediments and vegetation in the waterway, and restoration of degraded concrete will also be necessary. Routine maintenance operations are usually performed during the summer or early fall. All maintenance activities will be scheduled to minimize adverse impacts to fish and wildlife resources. Periods of concern are February through the end of August for birds and October through March for fish.

Periodic maintenance activities include sediment and debris removal and repair of facilities as necessary.

5.5 RIGHT OF WAY REQUIREMENTS

A temporary construction easement and right of entry will be needed at Central Expressway and Kifer Road. Also, temporary lane closures will be needed along Calabazas Boulevard at Machado Avenue and El Camino Real. A Caltrans Encroachment permit will be needed prior to performing work at El Camino Real.

Chapter 6 – Estimated Costs, Funding, and Schedule

6.1 COST

The estimated construction cost for the Project is $2.9 million. The construction areas are all within District owned right of way. Estimated quantities and order-of-magnitude costs for the recommended alternative are provided in Appendix A. There are no additional operation and maintenance costs.

Table 6-1. Estimated Project Construction Cost

Item	**Estimated Cost (2006 $)**
Mobilization	$236,000
Clearing and Grubbing	$60,000
Site Preparation	$430,000
Excavation and Disposal	$324,000
Concrete Structures	$1,000,000
Shoring	$18,000
Miscellaneous Work	$220,000
Site Restoration	$62,000
Right of Way Acquisition	$0
Utility relocation	$100,000
Quantity and Unit Cost Contingency	$450,000
TOTAL CONSTRUCTION COST	$2,900,000

6.2 FUNDING

The project will be funded by the West Valley Watershed Fund.

6.3 PROJECT ACTIVITIES AND SCHEDULE

A breakdown of the construction activities for the recommended project alternative is presented below:

- Mobilization
- Ramp removal and channel lining construction at Central Expressway and Kifer Road
- Flow separation wall removal at UPRR
- Low flow channel construction at Machado Avenue and El Camino Real
- Demobilization for whole project

The Project construction is estimated to take 275 calendar days to complete. Staff is planning to begin construction in April 2007 and complete the work by December 2007.

The proposed overall project schedule is presented in Table 6-2:

Table 6-2. Preliminary Project Schedule

Project Phase Element	Proposed Completion Date
Planning	May 2006
Conditional LMOR Application	August 2006
Right of Way	November 2006
Design	December 2006
Construction	December 2007
Final LOMR Application	December 2008

Chapter 7 – Conclusions and Recommendations

The Santa Clara Valley Water District is proposing to perform channel improvements along Calabazas Creek from Central Expressway to upstream of El Camino Real to remove 2,250 parcels from the existing one-percent floodplain.

The recommended project alternative (Alternative 2) consists of the demolition of an existing maintenance ramp downstream of Central Expressway; the demolition of an existing maintenance ramp upstream of Kifer Road; the demolition of a flow separation wall downstream of the UPRR bridge; the construction of a low flow channel beginning just upstream of Machado Avenue to about 640 feet downstream; and the construction of a low flow channel beginning downstream of El Camino Real to about 1,000 feet upstream. All project work is located in the City of Santa Clara.

The recommended project alternative supports District Board Policy No. E-2, Article 2.2.1.1, which states that "h*omes, schools, businesses, and transportation networks are protected from flooding and erosion.*"

Staff recommends approval of the preferred project alternative so that construction plans can be prepared for its implementation.

References

1. RS Means, *2006 Heavy Construction Cost Data 19th Annual Edition.*

2. Schaaf & Wheeler. February 2002, *Interior Drainage Analysis in Support of Request for A Letter of Map Revision (LOMR), Calabazas Creek Flood Control Project Between Guadalupe Slough and Arques Avenue, City of Santa Clara, California (Community No. 060350), City of Sunnyvale, California (Community No. 060352).*

3. SCVWD. September 1, 2005, *Calabazas Creek Capacity Improvement Project Miller Avenue to Central Expressway, Planning Phase Work Plan [Project Number: 20104018].*

4. SCVWD. HEC-RAS analysis of Calabazas Creek, January 2006.

5. SCVWD. Structural, Geotechnical, and Seismic Basis of Design Technical Memorandum, March 2006.

6. SCVWD. August 2005, Calabazas Creek Hydrology Report.

7. SCVWD. April 1992, *Calabazas Creek Planning Study, Guadalupe Slough to Miller Avenue, consisting of the combined Engineer's report and Final Environmental Impact Report.*

8. Wahler Associates. March 1992, *Environmental Investigation Report Phases 2 and 3 Calabazas Creek Alignment, Santa Clara County, California, Volumes 1 and II [Project SCV-152H].*

APPENDIX A

DETAILED CONSTRUCTION COST ESTIMATES

ALTERNATIVE 2 – CAPACITY IMPROVEMENT WITH CHANNEL MODIFICATIONS

Item	Unit Cost	Unit	Quantity	Amount
I. Site Preparation				
Control of Water	$102,000	LS	1	$102,000
Clearing and Grubbing	$20,800	LS	1	$20,800
Temporary Access Roads	$60	LF	500	$30,000
Concrete Structure Removal				
1. Maintenance Ramp & Lining @ Central Expwy	$10	SF	2,480	$24,800
2. Maintenance Ramp & Lining @ Kifer Road	$10	SF	3,100	$31,000
3. Flow Separation Wall @ UPRR	$15	SF	1,045	$15,675
4. Concrete Channel Bottom @ Machado Ave	$10	SF	8,025	$80,250
5. Concrete Channel Bottom @ El Camino Real	$10	SF	12,500	$125,000
Grouting for old Sanitary Sewer Line not in service*	$50	SF	40	$2,000
II. Structural Excavation				
Excavation				
1. Permeable material placement @ Central Expwy	$60	CY	90	$5,400
2. Permeable material placement @ Kifer Road	$60	CY	115	$6,900
3. Low Flow Channel @ Machado Ave	$60	CY	790	$47,400
4. Low Flow Channel @ El Camino Real	$60	CY	1,235	$74,100
5. Manholes and Sanitary Sewer Line (8-ft below grade)*	$80	CY	30	$2,400
Shoring for Low Channels	$4	SF	20,525	$82,100
III. Structural Backfill				
Backfill material placement @ Central Expwy	$70	CY	415	$29,050
Backfill material placement @ Kifer Road	$70	CY	705	$49,350
Backfill material placement @ Machado Ave	$70	CY	165	$11,550
Backfill material placement @ El Camino Real	$70	CY	255	$17,850
Structural backfill of Sanitary Sewer Line*	$80	CY	20	$1,600
IV. Structural Concrete				
Concrete Lining @ Central Expwy	$700	CY	140	$98,000
Concrete Lining @ Kifer Road	$700	CY	205	$143,500
Low Flow Channel @ Machado Ave	$700	CY	490	$343,000
Low Flow Channel @ El Camino Real	$700	CY	770	$539,000
Sanitary Sewer Manhole (2 locations)*	$3,000	EA	2	$6,000
V. Miscellaneous Work				
SWPPP and BMP Compliance	$31,000	LS	1	$31,000
Water Quality Monitoring & Measurements	$36,300	LS	1	$36,300
Migratory Bird Compliance	$25,000	LS	1	$25,000
10" Sanitary Sewer Line*	$60	LF	80	$4,800
VI. Site Restoration				
Erosion Control and Revegetation	$15	SF	3,600	$54,000
Fencing	$15	LF	500	$7,500
City Cost Index (0.163 multiplier)				$333,714
Subtotal				$2,381,039
Mobilize and Demobilize (10%)				$238,104
Escalation Factor (8%)				$190,483
Contingency (5%)				$119,052
*Coordination with City of Santa Clara				
Alternative No. 2 Total Construction Costs				**$2,928,678**

B.Tan (11/06)

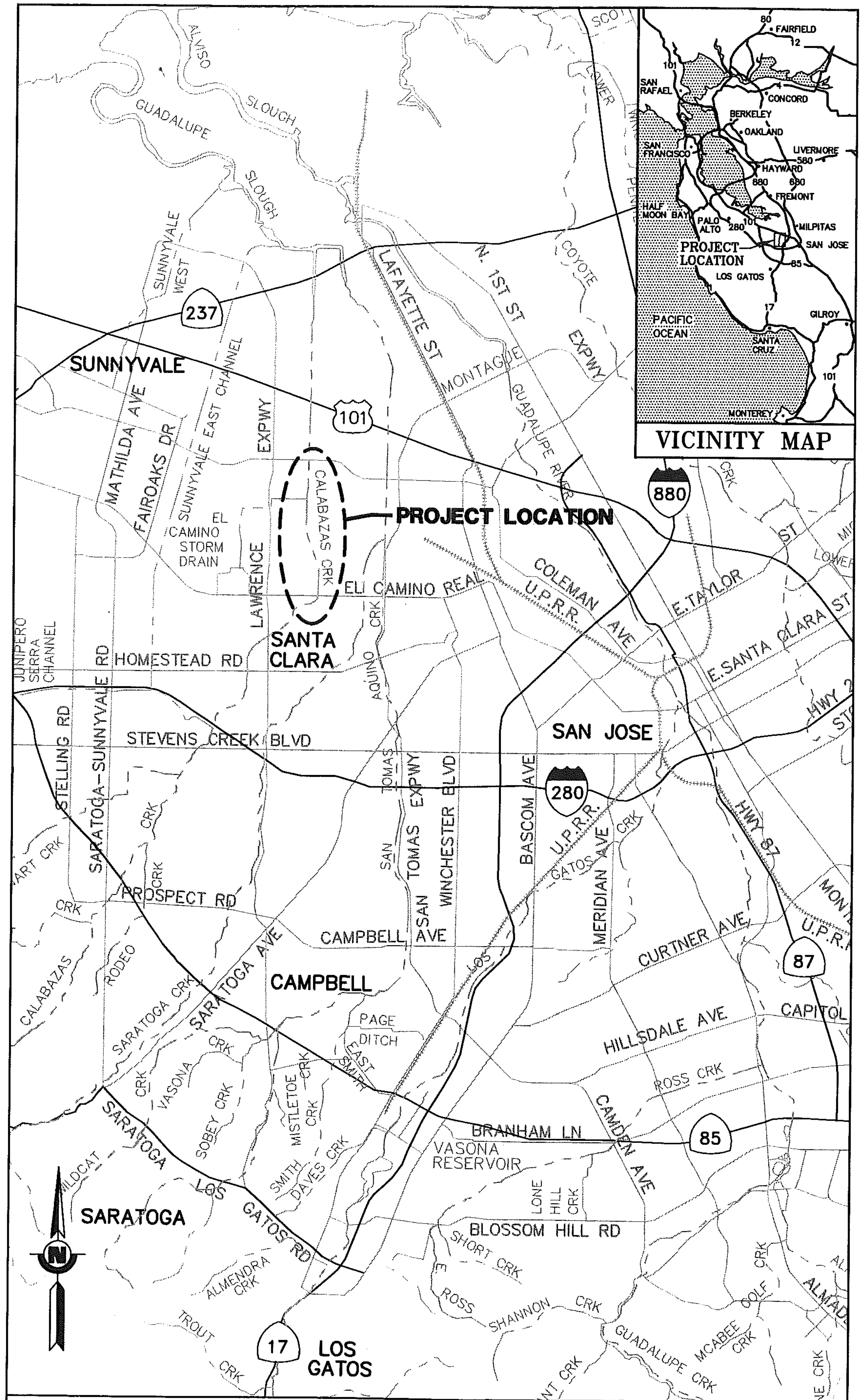
ALTERNATIVE 3 – CAPACITY IMPROVEMENT WITH BRIDGE MODIFICATION AT MACHADO

Item	Unit Price	Unit	Quantity	Amount
I. Site Preparation				
Control of Water	$121,000	LS	1	$121,000
Clearing and Grubbing	$20,800	LS	1	$20,800
Temporary Access Roads	$60	LF	500	$30,000
Concrete Structure Removal				
1. Maintenance Ramp & Lining @ Central Expwy	$10	SF	2,480	$24,800
2. Maintenance Ramp & Lining @ Kifer Road	$10	SF	3,100	$31,000
3. Flow Separation Wall @ UPRR	$15	SF	1,045	$15,675
4. Concrete Channel Bottom @ El Camino Real	$10	SF	12,500	$125,000
Grouting for old Sanitary Sewer Line not in service*	$50	SF	40	$2,000
II. Structural Excavation				
Excavation				
1. Permeable material placement @ Central Expwy	$60	CY	90	$5,400
2. Permeable material placement @ Kifer Road	$60	CY	115	$6,900
3. Low Flow Channel @ El Camino Real	$60	CY	1,235	$74,100
4. Manholes and Sanitary Sewer Line (8-ft below grade)*	$80	CY	30	$2,400
Shoring for Low Channel	$4	SF	12,500	$50,000
III. Structural Backfill				
Backfill material placement @ Central Expwy	$70	CY	415	$29,050
Backfill material placement @ Kifer Road	$70	CY	705	$49,350
Backfill material placement @ El Camino Real	$70	CY	255	$17,850
Structural backfill of Sanitary Sewer Line*	$80	CY	20	$1,600
IV. Structural Concrete				
Concrete Lining @ Central Expwy	$700	CY	140	$98,000
Concrete Lining @ Kifer Road	$700	CY	205	$143,500
Low Flow Channel @ El Camino Real	$700	CY	770	$539,000
Sanitary Sewer Manhole (2 locations)*	$3,000	EA	2	$6,000
V. Bridge Modifications				
Traffic Control and Detours (assuming full closure)	$80,000	LS	1	$80,000
Demolition Work (deck, temp shoring, haul/dump)	$40,000	LS	1	$40,000
Utility Replacement/Protection/Modification	$20,000	LS	1	$20,000
Bridge Raising (new roadway deck)	$825,825	LS	1	$825,825
Pavement Restoration (AC, striping, and signage)	$20,000	LS	1	$20,000
VI. Miscellaneous Work				
SWPPP and BMP Compliance	$31,000	LS	1	$31,000
Water Quality Monitoring & Measurements	$36,300	LS	1	$36,300
Migratory Bird Compliance	$25,000	LS	1	$25,000
10" Sanitary Sewer Line*	$60	LF	80	$4,800
VII. Site Restoration				
Erosion Control and Revegetation	$15	SF	3,600	$54,000
Fencing	$15	LF	500	$7,500
City Cost Index (0.163 multiplier)				$413,670
Subtotal				$2,951,520
Mobilize and Demobilize (10%)				$295,152
Escalation Factor (8%)				$236,122
Contingency (5%)				$147,576
*Coordination with City of Santa Clara				
Alternative No. 3 Total Construction Costs				**$3,630,369**

B.Tan (11/06)

APPENDIX B

MAP AND GENERAL PLANS



LOCATION MAP

SCALE: 1"=5000'

MAP AND GENERAL PLAN

FOR

CALABAZAS CREEK

CAPACITY IMPROVEMENT PROJECT

CENTRAL EXPRESSWAY TO EL CAMINO REAL

Santa Clara Valley Water District℠

PROJECT APPROVAL:

SAEID HOSSEINI — DATE
SENIOR PROJECT MANAGER – CPSD
SANTA CLARA VALLEY WATER DISTRICT

SAEID S. HOSSEINI
No. 50920
9/30/07
CIVIL

KATHERINE OVEN — DATE
ASSISTANT OPERATING OFFICER – CPSD
SANTA CLARA VALLEY WATER DISTRICT

ACCEPTED BY:

BEAU GOLDIE — DATE
DEPUTY OPERATING OFFICER – WVWD
SANTA CLARA VALLEY WATER DISTRICT

"FINAL"
ENGINEERS REPORT
11-21-06

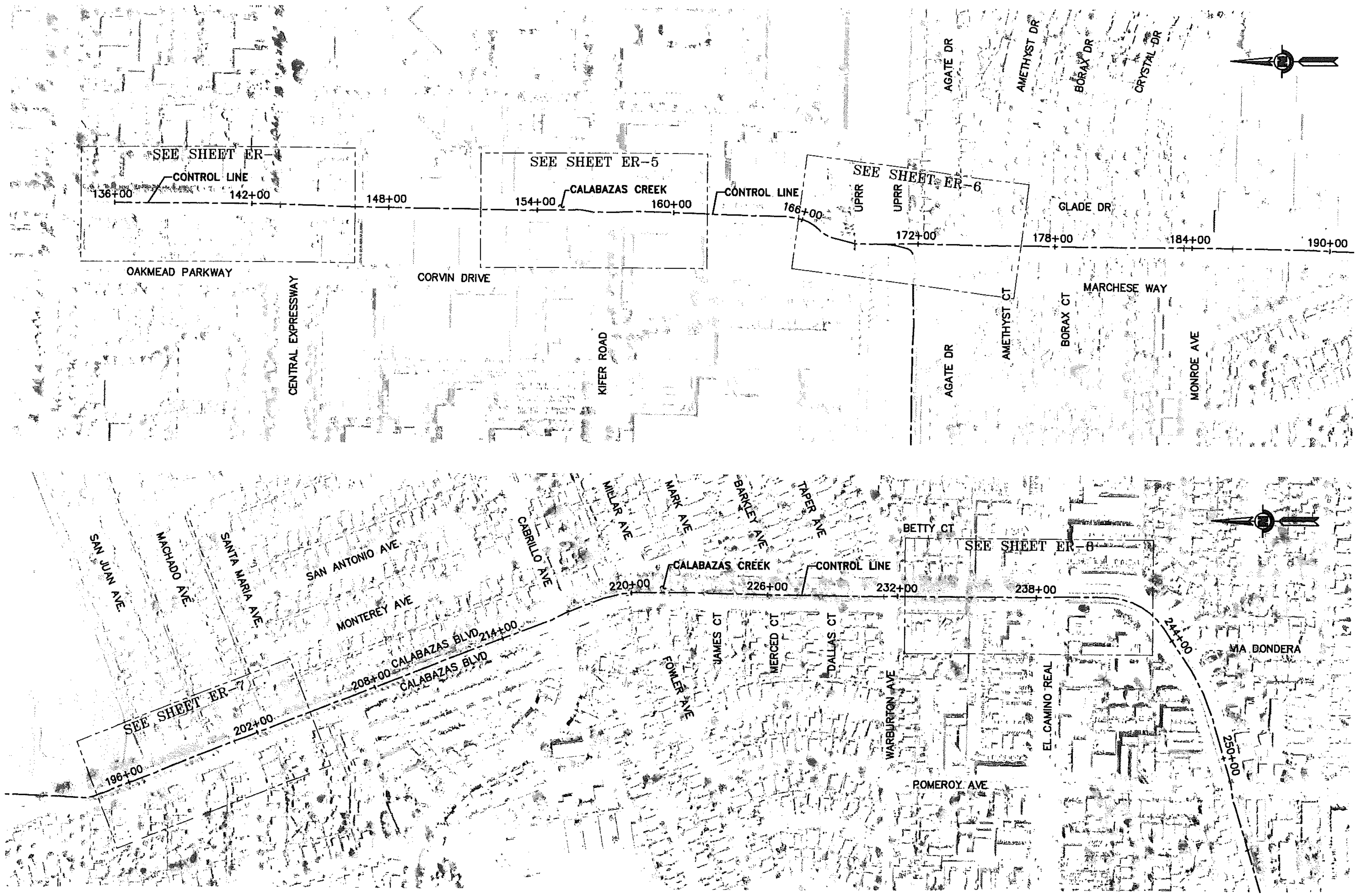
PROJECT NAME AND SHEET DESCRIPTION:	SCALE	PROJECT NUMBER
CALABAZAS CREEK CAPACITY IMPROVEMENT LOCATION MAP AND TITLE SHEET	AS SHOWN VERIFY SCALES 0 1" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	20104018 SHEET CODE: ER-1 PAGE NUMBER: 1 OF 9

USERNAME: NICOGARC Thu 07 Dec 2006 04:05pm
FILENAME: K:\Active Projects\MP-20104018\Planning Study\ER1

DOCUMENT NUMBER:CAA_WV-G-2010-0000000.00

USERNAME: NICOGARC Thu 07 Dec 2006 04:14pm
FILENAME: K:\Active Projects\MP-20104018\Planning Study\ER2

SHEET CODE	SHEET DESCRIPTION	PAGE NO.
ER-1	LOCATION MAP, TITLE SHEET	1 OF 9
ER-2	INDEX MAPS, DRAWING LIST AND GENERAL NOTES	2 OF 9
ER-3	ABBREVIATIONS, LEGEND AND SYMBOLS	3 OF 9
ER-4	PLAN AND PROFILE – CENTRAL EXPRESSWAY – REACH 1	4 OF 9
ER-5	PLAN AND PROFILE – KIFER ROAD – REACH 2	5 OF 9
ER-6	PLAN AND PROFILE – UPRR – REACH 3	6 OF 9
ER-7	PLAN AND PROFILE – MACHADO AVE – REACH 4	7 OF 9
ER-8	PLAN AND PROFILE – EL CAMINO REAL – REACH 5	8 OF 9
ER-9	TYPICAL SECTIONS	9 OF 9



INDEX MAPS

SCALE: NOT TO SCALE

GENERAL NOTES

1. ALL EXISTING FACILITIES, STRUCTURES, TREES, FENCES, LANDSCAPING, ETC., DESIGNATED "EXIST". OR SHOWN EXISTING (DASHED LINES) ARE TO REMAIN. ONLY THOSE SPECIFICALLY DESIGNATED FOR REMOVAL AS SHOWN ON THE DRAWINGS, OR AS DIRECTED BY THE ENGINEER SHALL BE REMOVED.
2. ALL REFERENCES MADE TO RIGHT OR LEFT AND ALL CROSS-SECTIONS SHOWN ON THE PLANS ARE VIEWED LOOKING UPSTREAM.
3. LOCATIONS AND DEPTHS OF EXISTING UNDERGROUND UTILITIES AS SHOWN ON THE PLANS ARE BASED ON INFORMATION FROM THE UTILITY COMPANY AND ARE TO BE CONSIDERED AS APPROXIMATE ONLY.
4. PRIOR TO PERFORMING ANY WORK IN THE VICINITY OF EXISTING UNDERGROUND UTILITIES, THE CONTRACTOR SHALL VERIFY THEIR LOCATION AND DEPTH AND TAKE PROPER PRECAUTIONS TO AVOID ANY DAMAGE TO THEM. CALL U.S.A. (UNDERGROUND SERVICE ALERT) 48 HOURS PRIOR TO COMMENCING WORK AT (800) 642-2444 FOR LOCATION.
5. THE CONTRACTOR SHALL INSTALL TEMPORARY FENCES AND OTHER WARNING SIGNS OR DEVICES AS REQUIRED.
6. THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE STATE WATER RESOURCES CONTROL BOARD FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITIES.
7. THE CONTRACTOR SHALL NOTIFY UPRR REPRESENTATIVES AT LEAST 24 HOURS IN ADVANCE, PRIOR TO COMMENCING WITH ANY WORK WITHIN 25 FEET OF ANY UPRR TRACK. ANY FLAG PERSONS OR OTHER SPECIAL PROTECTION AND SAFETY MEASURES PERFORMED BY UPRR SHALL BE AT THE CONTRACTOR'S EXPENSE.
8. THE CONTRACTOR'S OPERATIONS SHALL NOT INFRINGE ON THE FOLLOWING MINIMUM CLEARANCES FROM ANY RAILROAD TRACK: 10'-0" HORIZONTALLY FROM CENTER LINE OF TRACK AND 23'-0" VERTICALLY ABOVE TOP OF RAIL.
9. WORK IN STATE R/W IN BOLD SHEETS.

DESIGN NOTES

1. DISCHARGE CRITERIA:
   A. DESIGN DISCHARGE IS 3,800 CFS AT RAIL ROAD CROSSING.
2. MANNINGS ROUGHNESS COEFFICIENT (N) IS:
   A. CONCRETE CHANNEL = 0.013 – 0.018
3. UNIT STRESSES FOR REINFORCED CONCRETE ARE AS FOLLOWS:
   A. CONCRETE FC' PSI = 4,000 OR AS OTHERWISE SPECIFIED
   B. STEEL FY PSI = 60,000 OR AS OTHERWISE SPECIFIED
4. SURVEY DATA:
   BASIS OF ELEVATION: NORTH AMERICAN VERTICAL DATUM 1929 (NAVD29). MEASURED IN U.S. SURVEY FEET.
   BASIS OF BEARING: NORTH AMERICAN HORIZONTAL DATUM 1983 (NAD83), CALIFORNIA STATE PLANE COORDINATE SYSTEM ZONE III.

DOCUMENT NUMBER:

REV	DESCRIPTION	DATE	APPR.
	"FINAL" ENGINEERS REPORT 11-21-06		

REFERENCE INFORMATION AND NOTES

1. AERIAL PHOTOGRAPHY WAS TAKEN APRIL 2002.

DATE	11-21-06
DESIGN	B. TAN
DRAWN	N. GARCIA
CHECKED	T. NDAH

ENGINEERING CERTIFICATION

TONY TEGHEN NDAH
No. C67634
Exp. 06/30/07
CIVIL

PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK CAPACITY IMPROVEMENT

INDEX MAPS, DRAWING LIST AND GENERAL NOTES

SCALE
AS SHOWN
VERIFY SCALES
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PROJECT NUMBER
20104018

SHEET CODE:
ER-2

PAGE NUMBER:
2 OF 9

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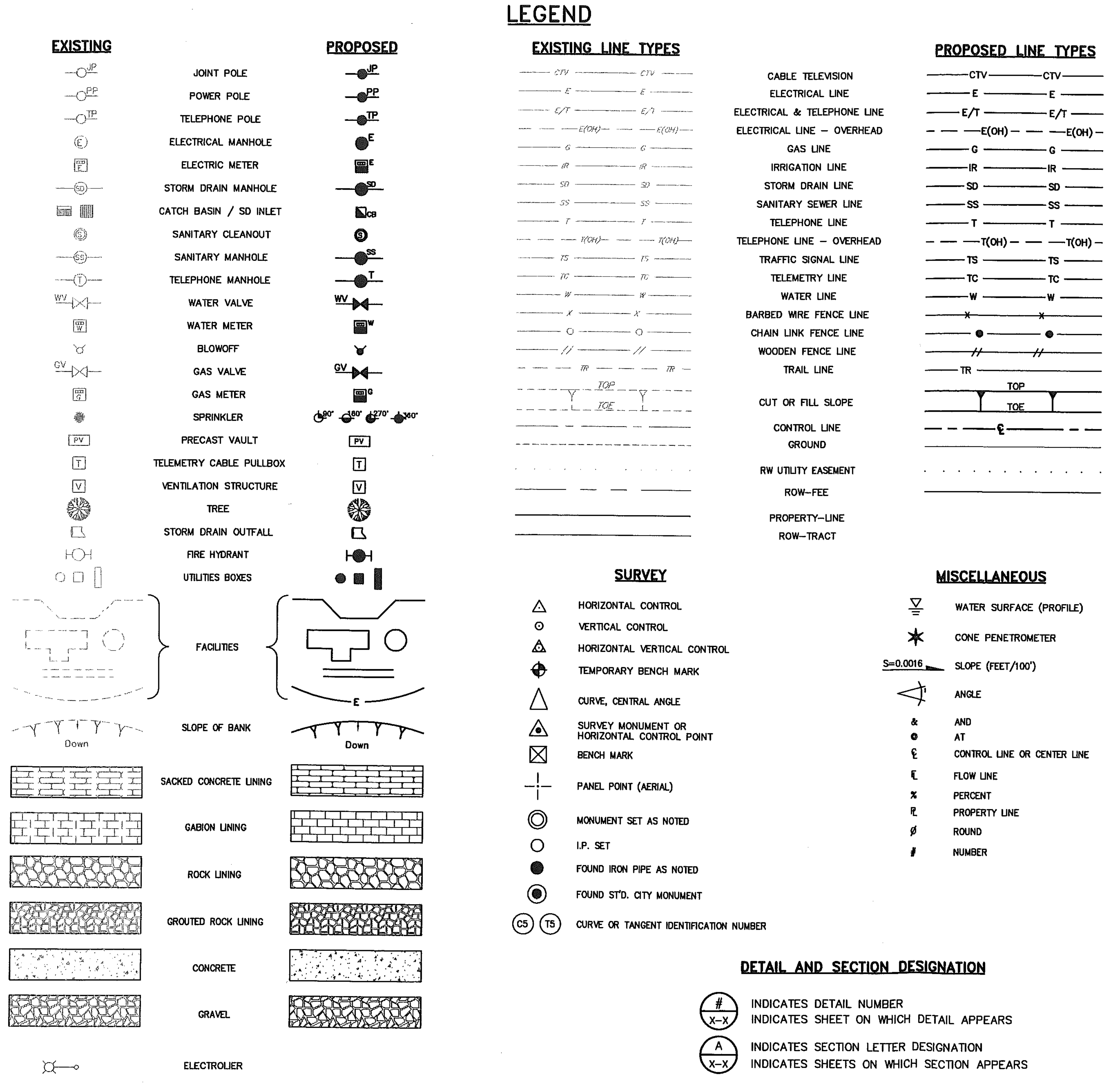
LEGEND



EXISTING / PROPOSED

- JOINT POLE
- POWER POLE
- TELEPHONE POLE
- ELECTRICAL MANHOLE
- ELECTRIC METER
- STORM DRAIN MANHOLE
- CATCH BASIN / SD INLET
- SANITARY CLEANOUT
- SANITARY MANHOLE
- TELEPHONE MANHOLE
- WATER VALVE
- WATER METER
- BLOWOFF
- GAS VALVE
- GAS METER
- SPRINKLER
- PRECAST VAULT
- TELEMETRY CABLE PULLBOX
- VENTILATION STRUCTURE
- TREE
- STORM DRAIN OUTFALL
- FIRE HYDRANT
- UTILITIES BOXES
- FACILITIES
- SLOPE OF BANK
- SACKED CONCRETE LINING
- GABION LINING
- ROCK LINING
- GROUTED ROCK LINING
- CONCRETE
- GRAVEL
- ELECTROLIER

EXISTING LINE TYPES / PROPOSED LINE TYPES

- CABLE TELEVISION
- ELECTRICAL LINE
- ELECTRICAL & TELEPHONE LINE
- ELECTRICAL LINE – OVERHEAD
- GAS LINE
- IRRIGATION LINE
- STORM DRAIN LINE
- SANITARY SEWER LINE
- TELEPHONE LINE
- TELEPHONE LINE – OVERHEAD
- TRAFFIC SIGNAL LINE
- TELEMETRY LINE
- WATER LINE
- BARBED WIRE FENCE LINE
- CHAIN LINK FENCE LINE
- WOODEN FENCE LINE
- TRAIL LINE
- CUT OR FILL SLOPE
- CONTROL LINE
- GROUND
- RW UTILITY EASEMENT
- ROW–FEE
- PROPERTY–LINE
- ROW–TRACT

SURVEY

- HORIZONTAL CONTROL
- VERTICAL CONTROL
- HORIZONTAL VERTICAL CONTROL
- TEMPORARY BENCH MARK
- CURVE, CENTRAL ANGLE
- SURVEY MONUMENT OR HORIZONTAL CONTROL POINT
- BENCH MARK
- PANEL POINT (AERIAL)
- MONUMENT SET AS NOTED
- I.P. SET
- FOUND IRON PIPE AS NOTED
- FOUND ST'D. CITY MONUMENT
- CURVE OR TANGENT IDENTIFICATION NUMBER

MISCELLANEOUS

- WATER SURFACE (PROFILE)
- CONE PENETROMETER
- SLOPE (FEET/100')
- ANGLE
- & AND
- @ AT
- ℄ CONTROL LINE OR CENTER LINE
- FLOW LINE
- % PERCENT
- PROPERTY LINE
- Ø ROUND
- # NUMBER

DETAIL AND SECTION DESIGNATION

- INDICATES DETAIL NUMBER
- INDICATES SHEET ON WHICH DETAIL APPEARS
- INDICATES SECTION LETTER DESIGNATION
- INDICATES SHEETS ON WHICH SECTION APPEARS

ABBREVIATIONS

ALT	– ALTERNATE, ALTERNATED
AB	– ANCHOR BOLT, AGGREGATE BASE
AC	– ASPHALT CONCRETE
ACI	– AMERICAN CONCRETE INSTITUTE
ALIGN	– ALIGNMENT, ALIGN
AMP	– AMPERE
APPROX	– APPROXIMATE, APPROXIMATELY
AVRD	– AVERAGE
ABUT	– ABUTMENT
ASSY	– ASSEMBLY
ACP	– ASBESTOS CEMENT PIPE
ASPH	– ASPHALT
AP	– ACCESS POINT
BC	– BEGIN CURVE
BF	– BOTH FACES
BM	– BENCH MARK
BRNG	– BEARING
BR	– BRIDGE
BW	– BARBED WIRE
BK	– BANK
BLDG	– BUILDING
BIT	– BITUMINOUS
BOT	– BOTTOM
C	– CURVE, CHORD
CB	– CATCH BASIN
CCP	– CONCRETE CYLINDER PIPE
CFM	– CUBIC FEET PER MINUTE
CFS	– CUBIC FEET PER SECOND
CIP	– CAST IRON PIPE
CJ	– CONSTRUCTION JOINT
CLR	– CLEAR, CLEARANCE
CL–6	– CHAIN LINK FENCE (NUMBER = HEIGHT)
CM	– CENTIMETER
CMP	– CORRUGATED METAL PIPE
CONC	– CONCRETE
CONST	– CONSTRUCT, CONSTRUCTION
CONT	– CONTINUOUS, CONTROL
CPI	– CURVE POINT OF INTERSECTION
CY	– CUBIC YARDS
CYL	– CYLINDER
COL	– COLUMN
CRK	– CREEK
DEG (°)	– DEGREES
DI	– DROP INLET
DIA	– DIAMETER
DIP	– DUCTILE IRON PIPE
DR	– DRIVE
D/S	– DOWNSTREAM
DBL	– DOUBLE
DWG	– DRAWING, DRAWINGS
DWN	– DOWN
DET	– DETAIL
E	– EAST
EJ	– EXPANSION JOINT
EA	– EACH
EC	– END CURVE
ELEV	– ELEVATION
ELECT	– ELECTRIC, ELECTRICAL
ENGR	– ENGINEER, ENGINEERING
EP	– EDGE OF PAVEMENT
EXIST	– EXISTING
EXPWY	– EXPRESSWAY
E'LY	– EASTERLY
EQU	– EQUATION
EF	– EACH FACE
EW	– EACH WAY
FD	– FOUND
FF	– FAR FACE
FG	– FINISH GRADE
FH	– FIRE HYDRANT
FT (')	– FEET, FOOT
FTG	– FOOTING
FWY	– FREEWAY
FB	– FREEBOARD

G	– GAS
GA	– GAUGE, GAGE
GAL	– GALVANIZE, GALVANIZED
GB	– GUY ANCHOR AND POLE
GB	– GRADE BREAK
GFI	– GROUND FAULT INTERRUPTER
GPM	– GALLONS PER MINUTE
GPS	– GALLONS PER SECOND
GR	– GRADE
GRND	– GROUND
GRP	– GROUP
GP	– GUY POLE
H	– HEIGHT
H&T	– HUB AND TACK
HORIZ	– HORIZONTAL
HP	– HORSEPOWER, HINGEPOINT
HWY	– HIGHWAY
HK	– HOOK (APPLIED TO REBAR)
I	– IRRIGATION
ID	– INSIDE DIAMETER
IF	– INSIDE FACE
IN (")	– INCH, INCHES
INV	– INVERT
IP	– IRON PIPE
JP	– JOINT POLE
JT	– JOINT
JUNCT	– JUNCTION
K	– KILO
Km	– KILOMETER
KV	– KILOVOLT
Kw	– KILOWATT
L	– LENGTH
LN	– LANE
LT	– LEFT
LP	– LIP OF GUTTER
M	– METER
MAINT	– MAINTENANCE
MAX	– MAXIMUM
MFP	– MODIFIED FLOOD PLAIN
MH	– MANHOLE
MIN	– MINIMUM
MON	– MONUMENT
MATL	– MATERIAL(S)
MEMB	– MEMBER
MTL	– METAL
NAVD	– NORTH AMERICAN VERTICAL DATUM
NGVD	– NATIONAL GEODETIC VERTICAL DATUM
N	– NORTH
N/A	– NOT APPLICABLE, NOT AVAILABLE
NE	– NORTHEAST
NE'LY	– NORTHEASTERLY
NF	– NEAR FACE
NIC	– NOT IN CONTRACT
NTS	– NOT TO SCALE
NW	– NORTHWEST
NW'LY	– NORTHWESTERLY
N'LY	– NORTHERLY
OC	– ON CENTER
OD	– OUTSIDE DIAMETER
OF	– OUTSIDE FACE
OH	– OVERHEAD
OPNG	– OPENING
PB	– PULL BOX
PCC	– PORTLAND CEMENT CONCRETE POINT OF COMPOUND CURVE
PI	– POINT OF INTERSECTION
POB	– POINT OF BEGINING
POT	– POINT OF TANGENT
PP	– POWER POLE
PRC	– POINT OF REVERSE CURVE
PSI	– POUNDS PER SQUARE INCH
PT	– POINT
PVC	– POLYVINYL CHLORIDE PIPE
PVMT	– PAVEMENT
PED	– PEDESTRIAN

Q	– DESIGN DISCHARGE
R	– RADIUS
RP	– RADIUS POINT
RCB	– REINFORCED CONCRETE BOX
RCP	– REINFORCED CONCRETE PIPE
RD	– ROAD
RCP	– REINFORCING STEEL BAR
REINF	– REINFORCEMENT, REINFORCING
REQ'D	– REQUIRED
RT	– RIGHT
RTE	– ROUTE
RR	– RAILROAD
R/W	– RIGHT OF WAY
REF	– REFERENCE, REFER
S	– SOUTH, SLOPE
SCRR	– SACK CONCRETE RIP–RAP
SCSP	– SACKED CONCRETE SLOPE PROTECTION
SCH	– SCHEDULE
SCVWD	– SANTA CLARA VALLEY WATER DISTRICT
SD	– STORM DRAIN, STANDARD DETAIL
SE	– SOUTHEAST
SEC (")	– SECONDS
SECT	– SECTION
SE'LY	– SOUTHEASTERLY
SHT	– SHEET
SPECS	– SPECIFICATIONS
SQ FT	– SQUARE FEET
SS	– SANITARY SEWER
STA	– STATION
STD	– STANDARD
STL	– STEEL
STR	– STRUCTURE
SW'LY	– SOUTHWESTERLY
SY	– SQUARE YARDS
SYM	– SYMMETRICAL
SW	– SOUTHWEST
S'LY	– SOUTHERLY
T	– TANGENT, TELEPHONE
TBM	– TEMPORARY BENCH MARK
TBD	– TO BE DETERMINED
TC	– TOP OF CURB
TCA	– TEMPORARY CONSTRUCTION AREA
TFC	– TRAFFIC
TB	– TOP OF BANK
TOC	– TOE OF CHANNEL
TP	– TELEPHONE POLE, TURNING POINT
TP–1	– TEST PIT (NUMBER=DESIGNATION/LOCATION)
TS	– TRAFFIC SIGNAL
TV	– TELEVISION (CABLE OR FACILITY)
TW	– TOP OF WALL
TYP	– TYPICAL
T&B	– TOP AND BOTTOM
UB	– UTILITY BOX
UC	– UTILITY CONDUIT
UG	– UNDERGROUND
U/S	– UPSTREAM
USC&GS	– UNITED STATES COASTAL AND GEODETIC SURVEY
V	– VOLTS
VCP	– VITRIFIED CLAY PIPE
VERT	– VERTICAL
W	– WITH, WATER, WEST, WIDTH, WIDE
W/O	– WITHOUT
WS	– WATER SURFACE
WT	– WEIGHT
WD	– WOOD, WOODEN
WSP	– WATER SURFACE PROFILE
WV	– WATER VALVE
WW	– WING WALL
WWF	– WELDED WIRE FABRIC
W'LY	– WESTERLY
X–SECT	– CROSS SECTION
Y	– YARDS
Z	– ZONE

DOCUMENT NUMBER:

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES
	"FINAL" ENGINEERS REPORT 11-21-06			

DATE
11–21–06
DESIGN
B. TAN
DRAWN
N. GARCIA
CHECKED
T. NDAH

ENGINEERING CERTIFICATION
TONY TEGHEN NDAH
No. C67634
Exp. 06/30/07
CIVIL
PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK
CAPACITY IMPROVEMENT
ABBREVIATIONS, LEGEND AND SYMBOLS

SCALE
NOT TO SCALE
VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER
20104018
SHEET CODE:
ER–3
PAGE NUMBER:
3 OF 9

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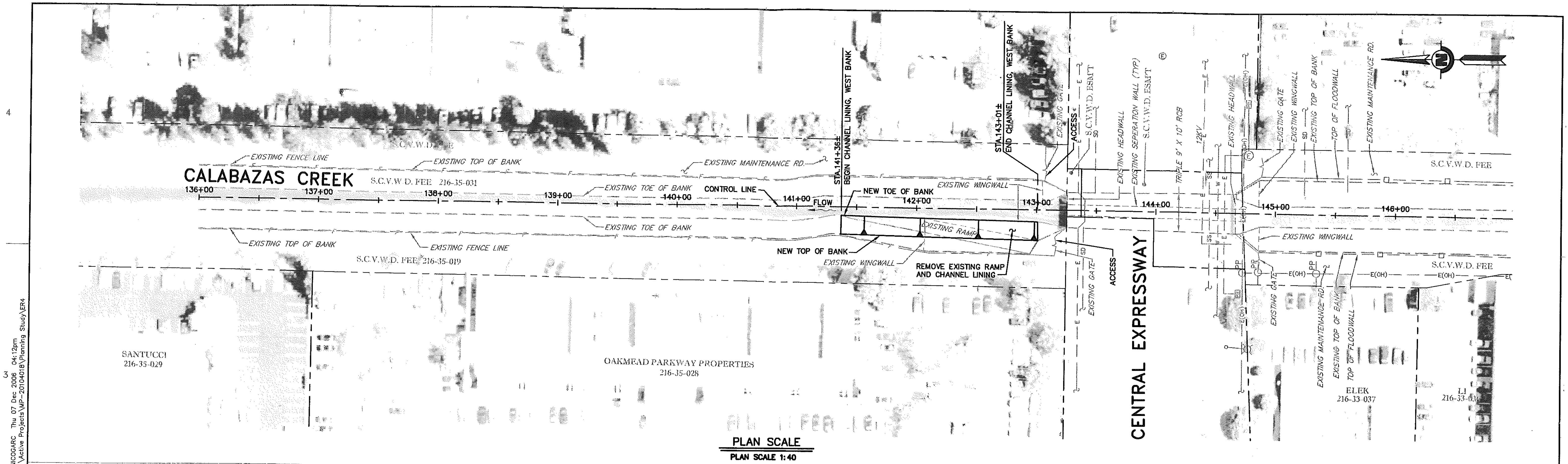
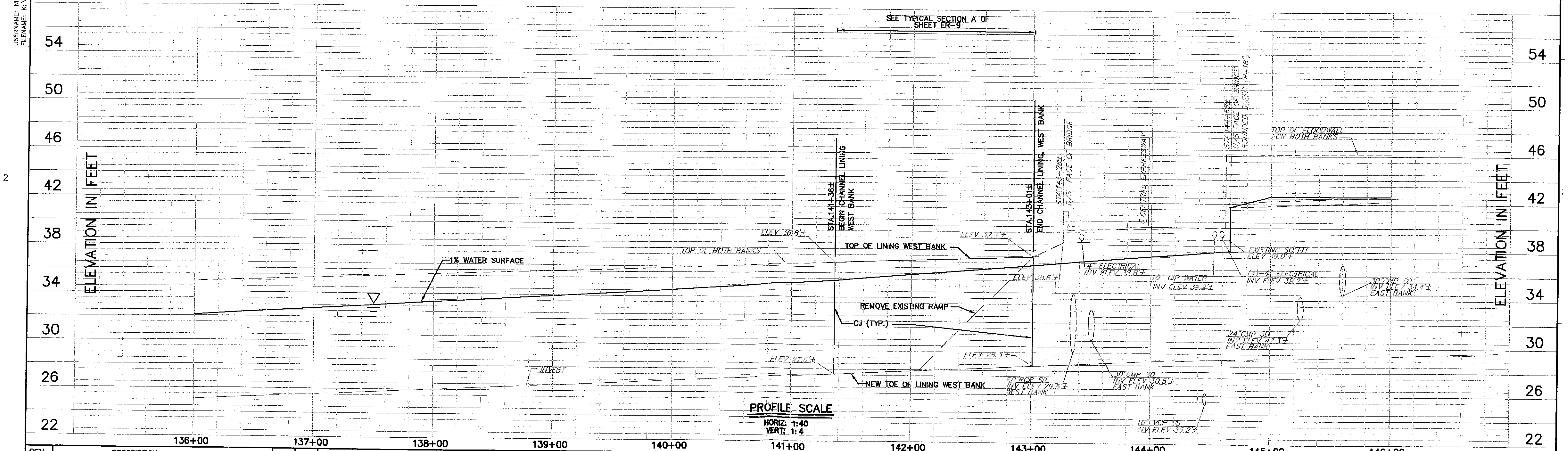
FILENAME: K:\Active Projects\MP-20104018\Planning Study\ER4




SEE TYPICAL SECTION A OF SHEET ER-9
ELEVATION IN FEET
54
50
46
42
38
34
30
26
22
STA.141+36± BEGIN CHANNEL LINING WEST BANK
STA.143+01± END CHANNEL LINING, WEST BANK
STA.143+26± D/S FACE OF BRIDGE
℄ CENTRAL EXPRESSWAY
STA.144+66± U/S FACE OF BRIDGE ROUNDED SOFFIT (R=18')
TOP OF FLOODWALL FOR BOTH BANKS
1% WATER SURFACE
TOP OF BOTH BANKS
ELEV 36.8'±
ELEV 37.4'±
TOP OF LINING WEST BANK
ELEV 36.6'±
4" ELECTRICAL INV ELEV 34.8'±
10" CIP WATER INV ELEV 39.2'±
(4)-4" ELECTRICAL INV ELEV 39.2'±
EXISTING SOFFIT ELEV 39.0'±
30"CMP SD INV ELEV 34.4'± EAST BANK
REMOVE EXISTING RAMP
CJ (TYP.)
ELEV 28.3'±
ELEV 27.6'±
INVERT
NEW TOE OF LINING WEST BANK
60"RCP SD INV ELEV 29.5'± WEST BANK
30"CMP SD INV ELEV 30.5'± EAST BANK
24"CMP SD INV ELEV 40.3'± EAST BANK
10" VCP SS INV ELEV 25.2'±
PROFILE SCALE
HORIZ: 1:40
VERT: 1:4
136+00
137+00
138+00
139+00
140+00
141+00
142+00
143+00
144+00
145+00
146+00

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES
	"FINAL" ENGINEERS REPORT 11-21-06			1. AERIAL PHOTOGRAPHY WAS TAKEN APRIL 2002.

DOCUMENT NUMBER:

DATE	11-21-06
DESIGN	B. TAN
DRAWN	N. GARCIA
CHECKED	T. NDAH

ENGINEERING CERTIFICATION

TONY TEGHEN NDAH
No. C67634
Exp. 06/30/07
CIVIL

PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK
CAPACITY IMPROVEMENT
PLAN AND PROFILE
CENTRAL EXPRESSWAY
REACH 1

SCALE: AS SHOWN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER: 20104018

SHEET CODE: ER-4

PAGE NUMBER: 4 OF 9

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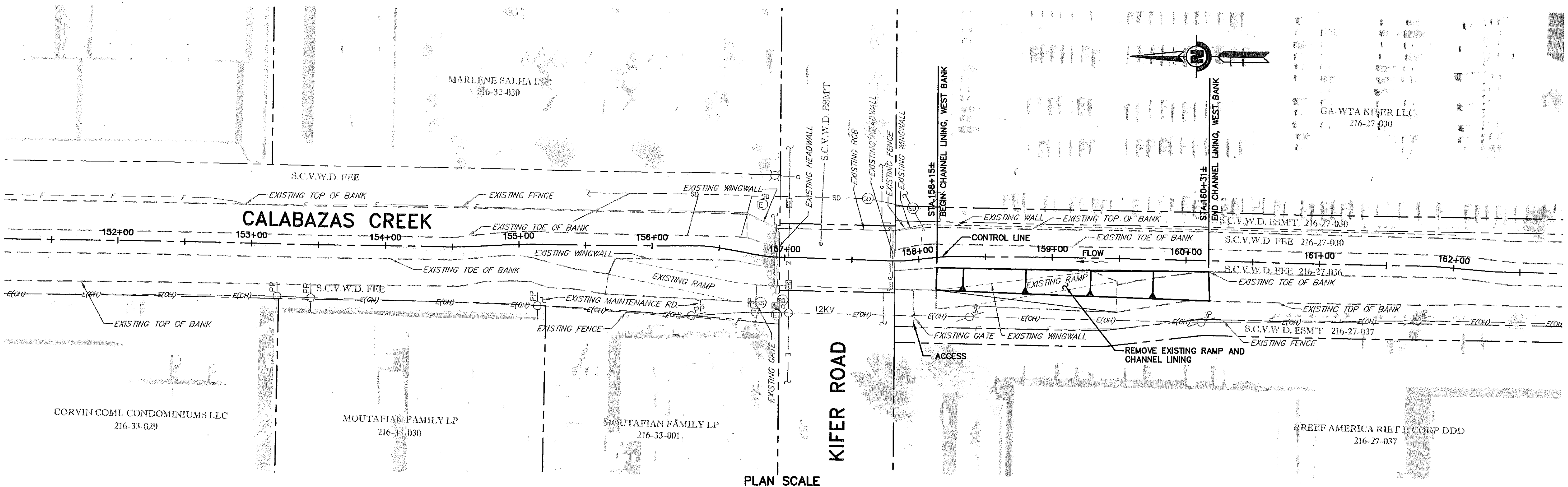
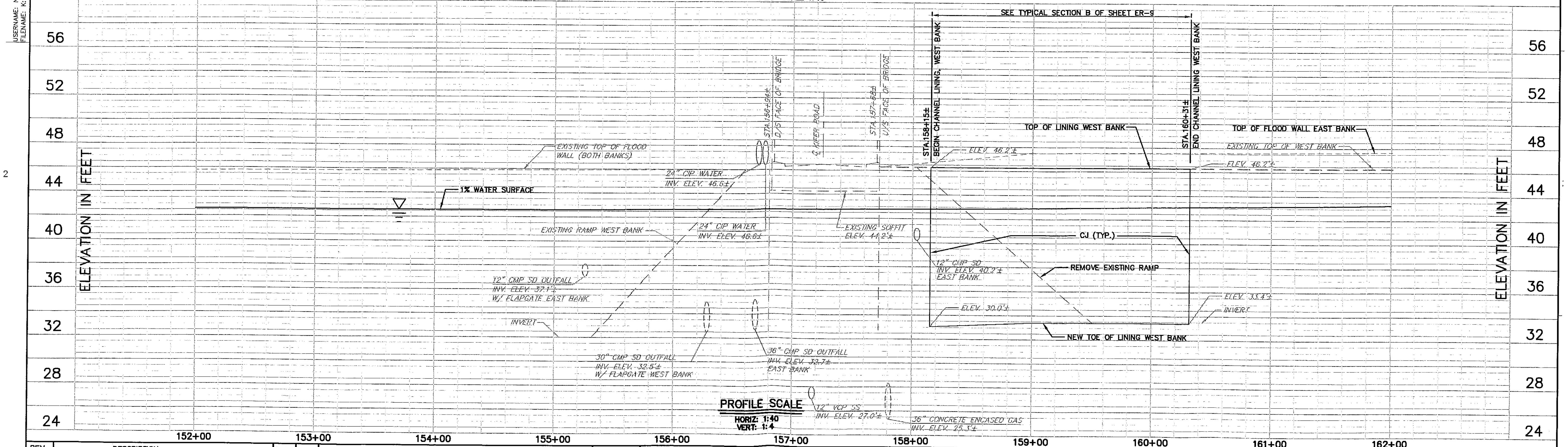


PLAN SCALE
PLAN SCALE 1:40



DOCUMENT NUMBER:

REV	DESCRIPTION	DATE	APPR.
	"FINAL" ENGINEERS REPORT 11-21-06		

REFERENCE INFORMATION AND NOTES
1. AERIAL PHOTOGRAPHY WAS TAKEN APRIL 2002.

DATE	11-21-06
DESIGN	B. TAN
DRAWN	N. GARCIA
CHECKED	T. NDAH

ENGINEERING CERTIFICATION
TONY TEGHEN NDAH
No. C67634
Exp. 06/30/07
PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

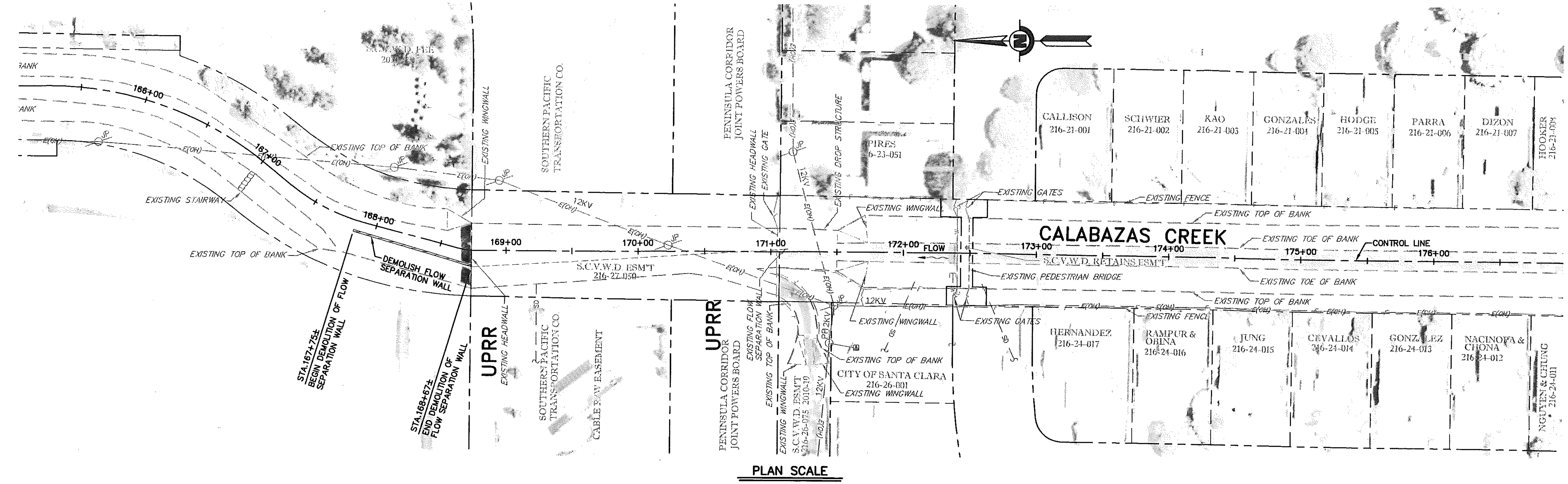
CALABAZAS CREEK CAPACITY IMPROVEMENT

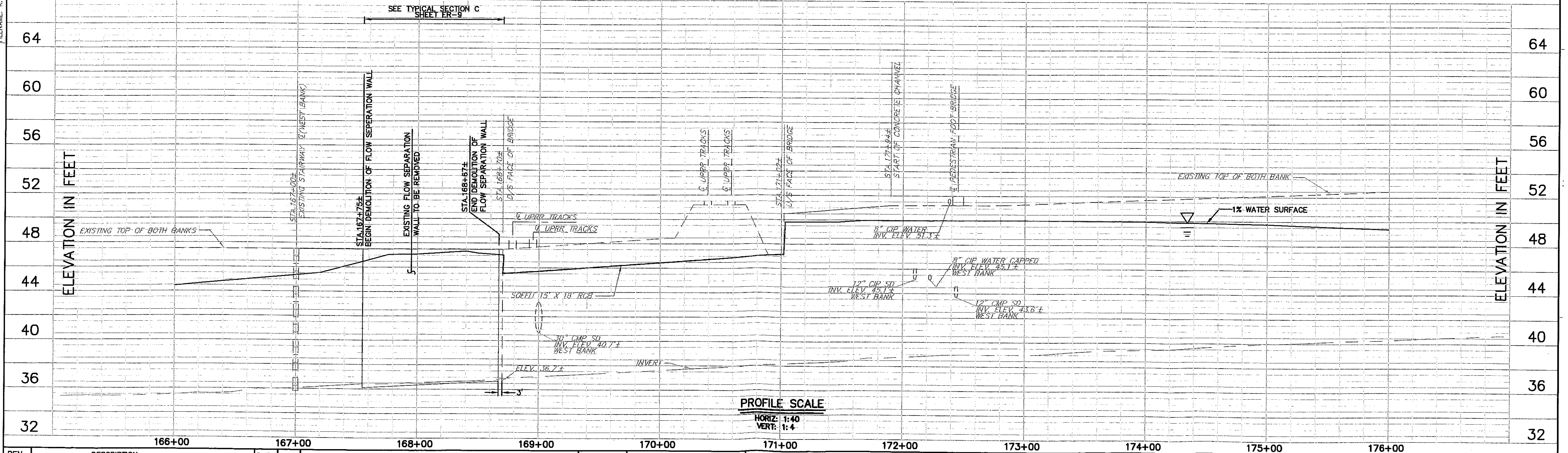
PLAN AND PROFILE
KIFER ROAD
REACH 2

SCALE
AS SHOWN
VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER
20104018
SHEET CODE:
ER-5
PAGE NUMBER:
5 OF 9

USERNAME: NICOGARC Thu 07 Dec 2006 04:06pm
FILENAME: K:\Active Projects\MP-20104018\Planning Study\ER6




SEE TYPICAL SECTION C SHEET ER-9
ELEVATION IN FEET
64
60
56
52
48
44
40
36
32
STA.167+00± EXISTING STAIRWAY (WEST BANK)
STA.167+75± BEGIN DEMOLITION OF FLOW SEPERATION WALL
EXISTING FLOW SEPARATION WALL TO BE REMOVED
STA.168+67± END DEMOLITION OF FLOW SEPARATION WALL
STA.168+70± D/S FACE OF BRIDGE
℄ UPRR TRACKS
STA.171+02± U/S FACE OF BRIDGE
STA.171+94± START OF CONCRETE CHANNEL
℄ PEDESTRIAN FOOT BRIDGE
EXISTING TOP OF BOTH BANKS
EXISTING TOP OF BOTH BANK
1% WATER SURFACE
SOFFIT 15' X 18' RCB
30" CMP SD INV. ELEV. 40.7'± WEST BANK
ELEV. 36.7±
INVERT
3'
8" CIP WATER INV. ELEV. 51.3±
8" CIP WATER CAPPED INV. ELEV. 45.1± WEST BANK
12" CIP SD INV. ELEV. 45.1± WEST BANK
12" CMP SD INV. ELEV. 43.6± WEST BANK
PROFILE SCALE
HORIZ: 1:40
VERT: 1:4
166+00
167+00
168+00
169+00
170+00
171+00
172+00
173+00
174+00
175+00
176+00

REV	DESCRIPTION	DATE	APPR.
	"FINAL" ENGINEERS REPORT 11-21-06		

REFERENCE INFORMATION AND NOTES

1. AERIAL PHOTOGRAPHY WAS TAKEN APRIL 2002.

DATE 11-21-06
DESIGN B. TAN
DRAWN N. GARCIA
CHECKED T. NDAH

ENGINEERING CERTIFICATION
TONY TEGHEN NDAH No. C67634 Exp. 06/30/07 CIVIL
PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK CAPACITY IMPROVEMENT
PLAN AND PROFILE
UPRR
REACH 3

SCALE: AS SHOWN
VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY
PROJECT NUMBER: 20104018
SHEET CODE: ER-6
PAGE NUMBER: 6 OF 9

DOCUMENT NUMBER:

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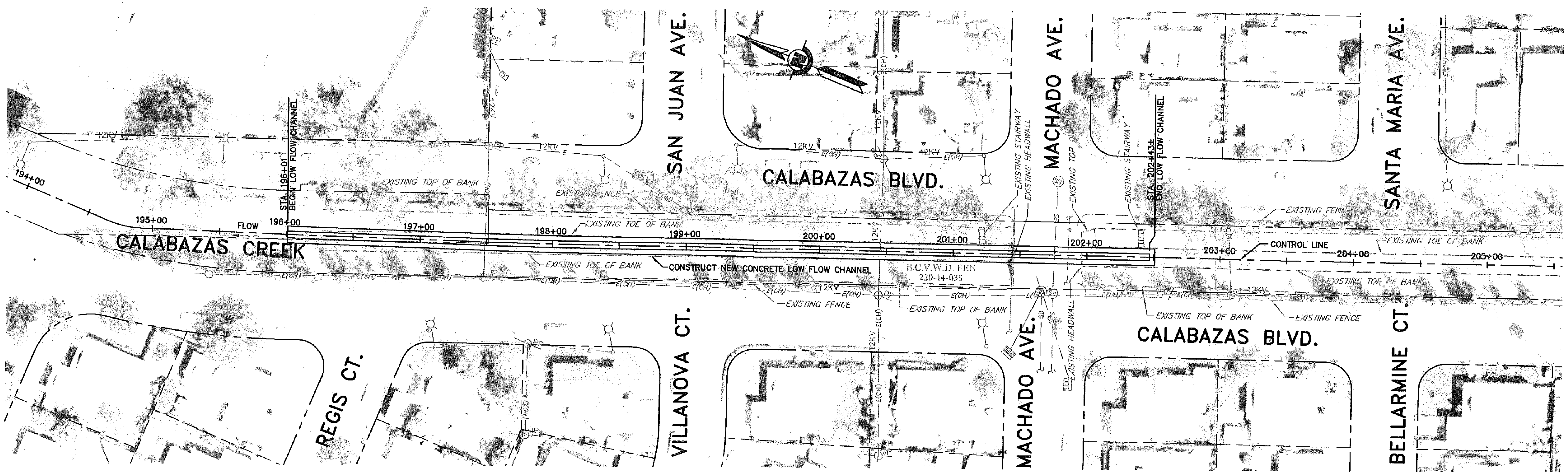
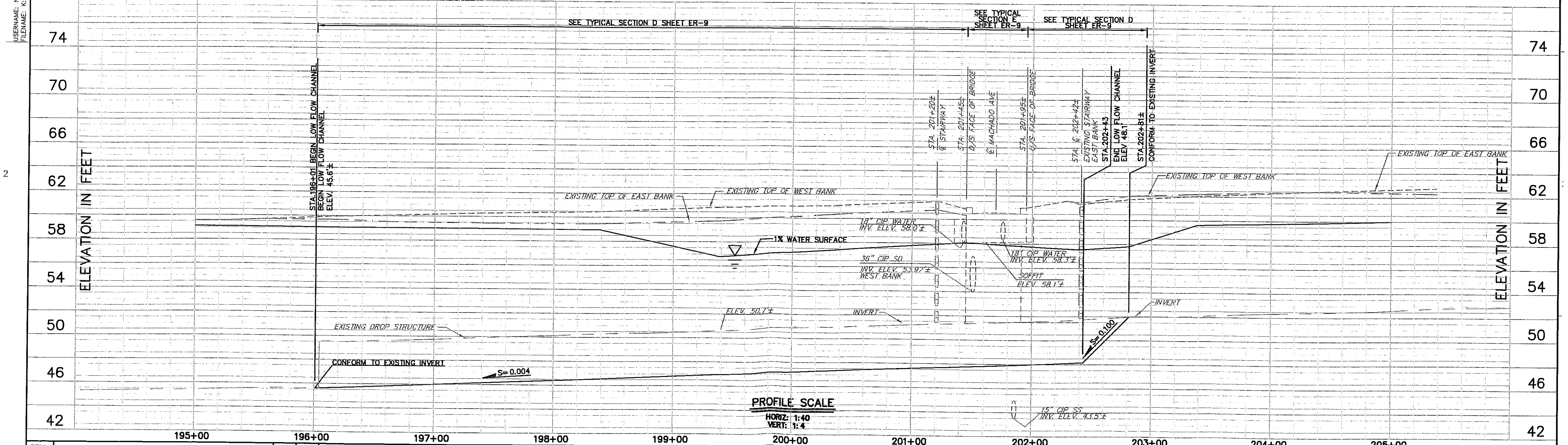


PLAN SCALE
PLAN SCALE 1:40


ELEVATION IN FEET
74
70
66
62
58
54
50
46
42
SEE TYPICAL SECTION D SHEET ER-9
SEE TYPICAL SECTION E SHEET ER-9
SEE TYPICAL SECTION D SHEET ER-9
STA. 196+01 BEGIN LOW FLOW CHANNEL
BEGIN LOW FLOW CHANNEL ELEV. 45.6'±
STA. 201+20± ℄ STAIRWAY
STA. 201+45± D/S FACE OF BRIDGE
℄ MACHADO AVE
STA. 201+95± U/S FACE OF BRIDGE
STA. ℄ 202+42± EXISTING STAIRWAY EAST BANK
STA. 202+43 END LOW FLOW CHANNEL ELEV. 48.1'
STA. 202+81± CONFORM TO EXISTING INVERT
EXISTING TOP OF EAST BANK
EXISTING TOP OF WEST BANK
EXISTING TOP OF WEST BANK
EXISTING TOP OF EAST BANK
1% WATER SURFACE
18" CIP WATER INV. ELEV. 58.0'±
36" CIP SD INV. ELEV. 53.97'± WEST BANK
18" CIP WATER INV. ELEV. 58.3'±
SOFFIT ELEV. 58.1'±
ELEV. 50.7'±
INVERT
INVERT
EXISTING DROP STRUCTURE
CONFORM TO EXISTING INVERT
S= 0.004
S= 0.100
15" CIP SS INV. ELEV. 43.5'±
195+00
196+00
197+00
198+00
199+00
200+00
201+00
202+00
203+00
204+00
205+00

PROFILE SCALE
HORIZ: 1:40
VERT: 1:4

REV	DESCRIPTION	DATE	APPR.
	"FINAL" ENGINEERS REPORT 11-21-06		

DOCUMENT NUMBER:

REFERENCE INFORMATION AND NOTES

1. AERIAL PHOTOGRAPHY WAS TAKEN APRIL 2002.

DATE
10-02-06
DESIGN
B. TAN
DRAWN
N. GARCIA
CHECKED
T. NDAH

ENGINEERING CERTIFICATION

TONY TEGHEN NDAH
No. C67634
Exp. 06/30/07

PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK CAPACITY IMPROVEMENT
PLAN AND PROFILE
MACHADO AVENUE
REACH 4

SCALE
AS SHOWN

VERIFY SCALES
0 1"
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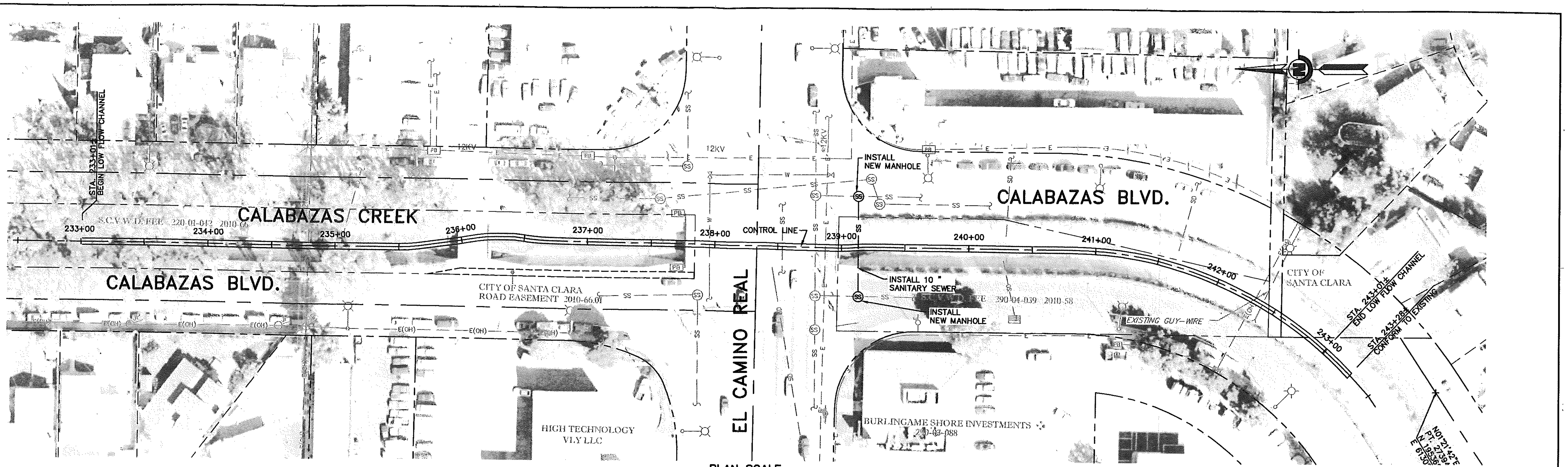
PROJECT NUMBER
20104018

SHEET CODE:
ER-7

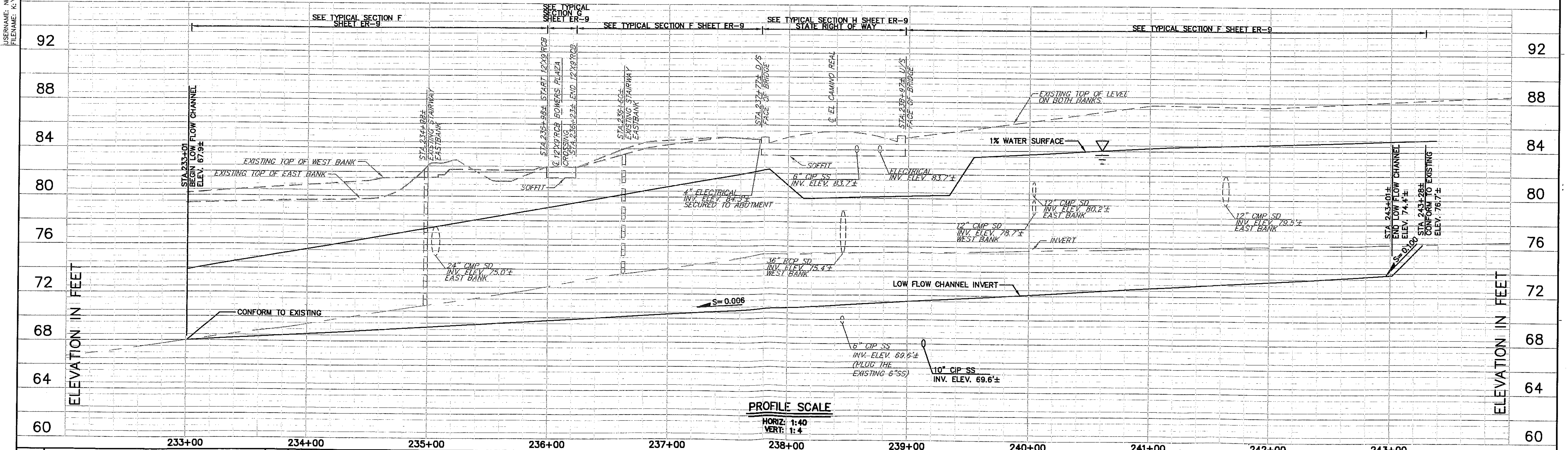
PAGE NUMBER:
7 OF 9

USERNAME: NICOGARC Thu 07 Dec 2006 04:04pm
FILENAME: K:\Active Projects\MP-20104018\Planning Study\ER8


STA. 233+01± BEGIN LOW FLOW CHANNEL
S.C.V.W.D. FEE 220-01-042 2010-67
CALABAZAS CREEK
CALABAZAS BLVD.
CITY OF SANTA CLARA ROAD EASEMENT 2010-66.01
HIGH TECHNOLOGY VLY LLC
EL CAMINO REAL
CONTROL LINE
12KV
INSTALL NEW MANHOLE
INSTALL 10" SANITARY SEWER
INSTALL NEW MANHOLE
S.C.V.W.D. FEE 290-04-039 2010-58
BURLINGAME SHORE INVESTMENTS 290-03-088
CALABAZAS BLVD.
EXISTING GUY-WIRE
CITY OF SANTA CLARA
STA. 243+01± END LOW FLOW CHANNEL
STA. 243+28± CONFORM TO EXISTING
233+00
234+00
235+00
236+00
237+00
238+00
239+00
240+00
241+00
242+00
243+00

PLAN SCALE

PLAN SCALE 1:40



PROFILE SCALE

HORIZ: 1:40
VERT: 1:4

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES
	"FINAL" ENGINEERS REPORT 11-21-06			1. AERIAL PHOTOGRAPHY WAS TAKEN APRIL 2002

DOCUMENT NUMBER:

DATE	11-21-06
DESIGN	B. TAN
DRAWN	N. GARCIA
CHECKED	T. NDAH

ENGINEERING CERTIFICATION

TONY TEGHEN NDAH
No. C67634
Exp. 06/30/07

PROJECT ENGINEER MM-DD-YY

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK CAPACITY IMPROVEMENT
PLAN AND PROFILE
EL CAMINO REAL
REACH 5

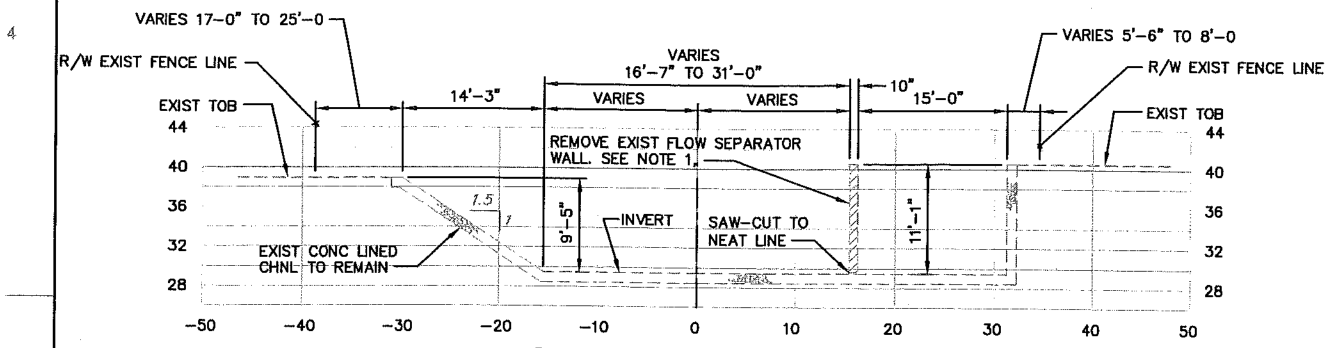
SCALE: AS SHOWN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER: 20104018

SHEET CODE: ER-8

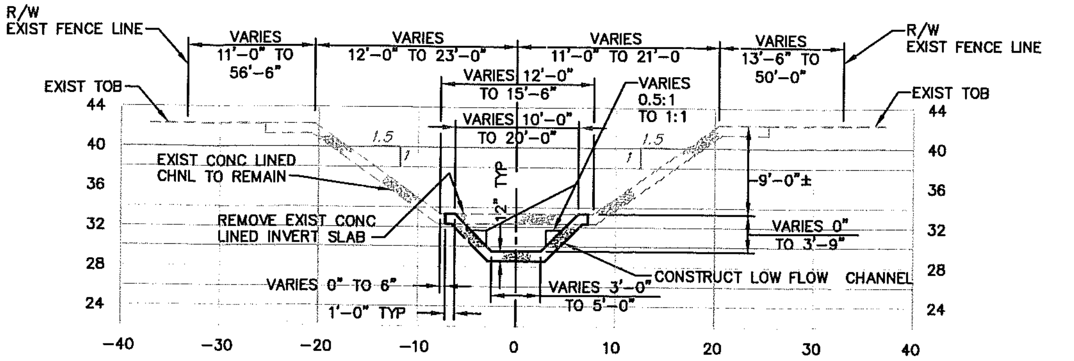
PAGE NUMBER: 8 OF 9



SECTION C/ER-9 TYPICAL SECTION AT UPRR

STA 167+75 TO STA 168+67

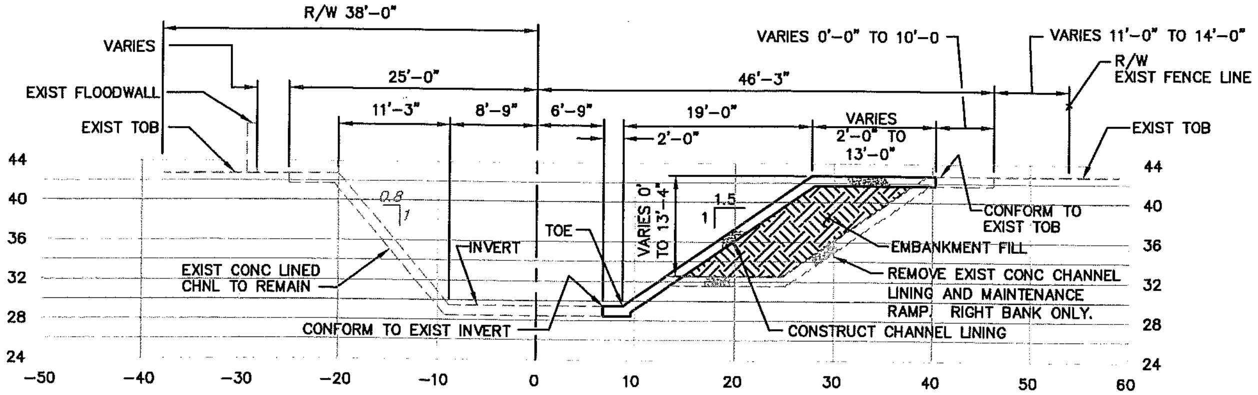
NTS



SECTION F/ER-9 TYPICAL SECTION AT EL CAMINO REAL

STA 233+01 TO STA 235+98
STA 236+23 TO STA 237+77
STA 238+97 TO STA 243+24

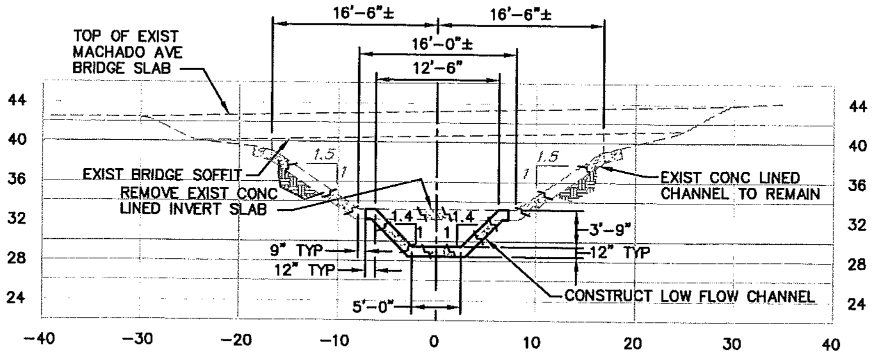
NTS



SECTION B/ER-9 TYPICAL SECTION AT KIFER ROAD

STA 158+15 TO STA 160+31

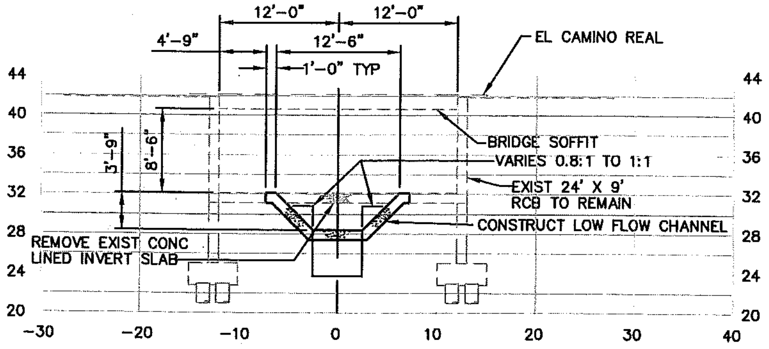
NTS


TOP OF EXIST MACHADO AVE BRIDGE SLAB
16'-6"±
16'-6"±
16'-0"±
12'-6"
EXIST BRIDGE SOFFIT
REMOVE EXIST CONC LINED INVERT SLAB
1.5
1
1.5
1
1.4
1
1.4
EXIST CONC LINED CHANNEL TO REMAIN
3'-9"
9" TYP
12" TYP
12" TYP
5'-0"
CONSTRUCT LOW FLOW CHANNEL
44
40
36
32
28
24
-40
-30
-20
-10
0
10
20
30
40

SECTION E/ER-9 TYPICAL SECTION AT MACHADO AVE BRIDGE

STA 201+45 TO STA 201+95

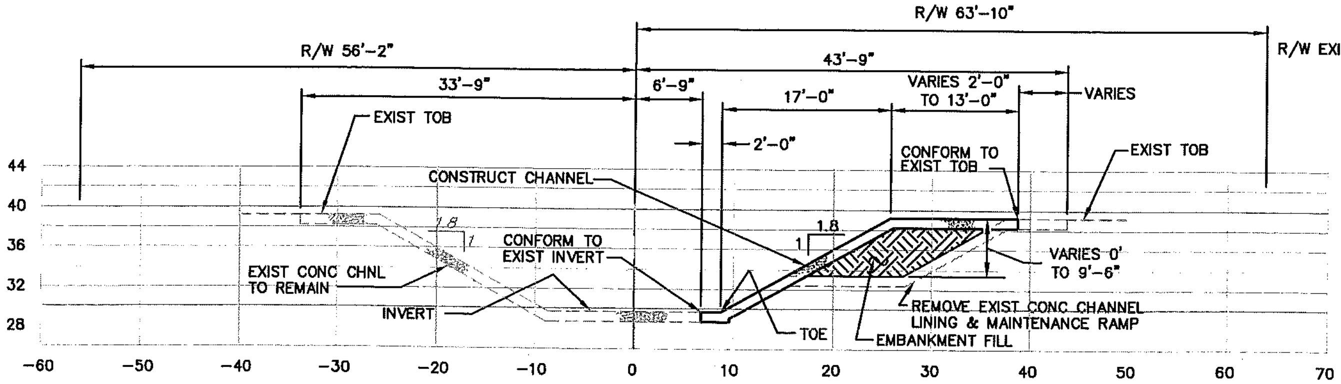
NTS



SECTION H/ER-9 TYPICAL SECTION AT EL CAMINO REAL BRIDGE

STA 237+77 TO STA 238+97

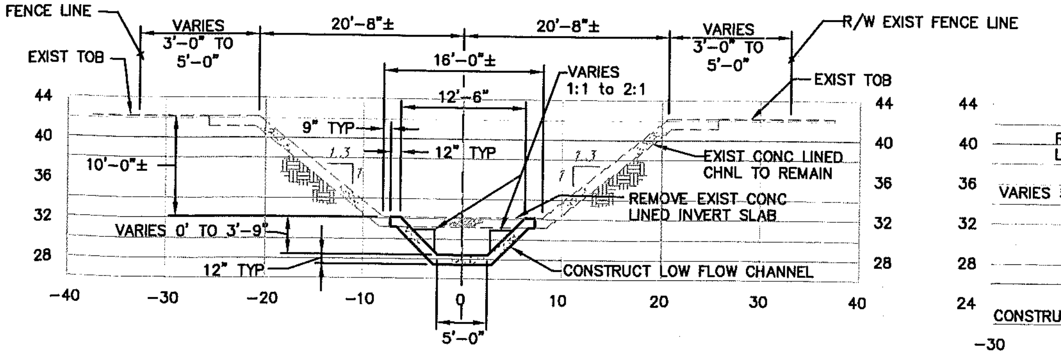
NTS



SECTION A/ER-9 TYPICAL SECTION AT CENTRAL EXPRESSWAY

STA 141+36 TO STA 143+01

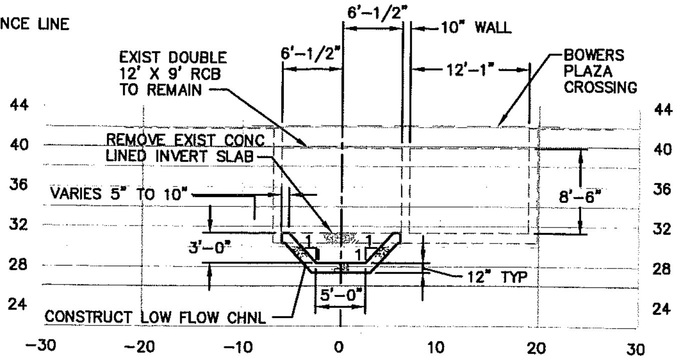
NTS



SECTION D/ER-9 TYPICAL SECTION AT MACHADO AVE

STA 196+01 TO STA 201+45
STA 201+95 TO STA 202+83

NTS



SECTION G/ER-9 TYPICAL SECTION AT BOWERS PLAZA CROSSING

STA 235+98 TO STA 236+23

NTS

REV	DESCRIPTION	DATE	APPR.
	"FINAL" ENGINEERS REPORT 11-21-06		

REFERENCE INFORMATION AND NOTES

1. RETAIN 3' (FT) OF WALL FROM D/S FACE OF R/R BRIDGE CROSSING.

DATE	11-21-06
DESIGN	B. TAN
DRAWN	N. GARCIA
CHECKED	T. NDAH

ENGINEERING CERTIFICATION

TONY TEGHEN NDAH No. C67634 Exp. 06/30/07

PROJECT ENGINEER DATE

Santa Clara Valley Water District

PROJECT NAME AND SHEET DESCRIPTION:

CALABAZAS CREEK CAPACITY IMPROVEMENT

TYPICAL SECTIONS

SCALE: AS SHOWN

VERIFY SCALES: 0 1"

BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER: 20104018

SHEET CODE: ER-9

PAGE NUMBER: 9 OF 9

DOCUMENT NUMBER:

USERNAME: NICOGARC Thu, 07 Dec 2006 04:03pm
FILENAME: K:\Active Projects\WP-20104018\Planning Study\ER9